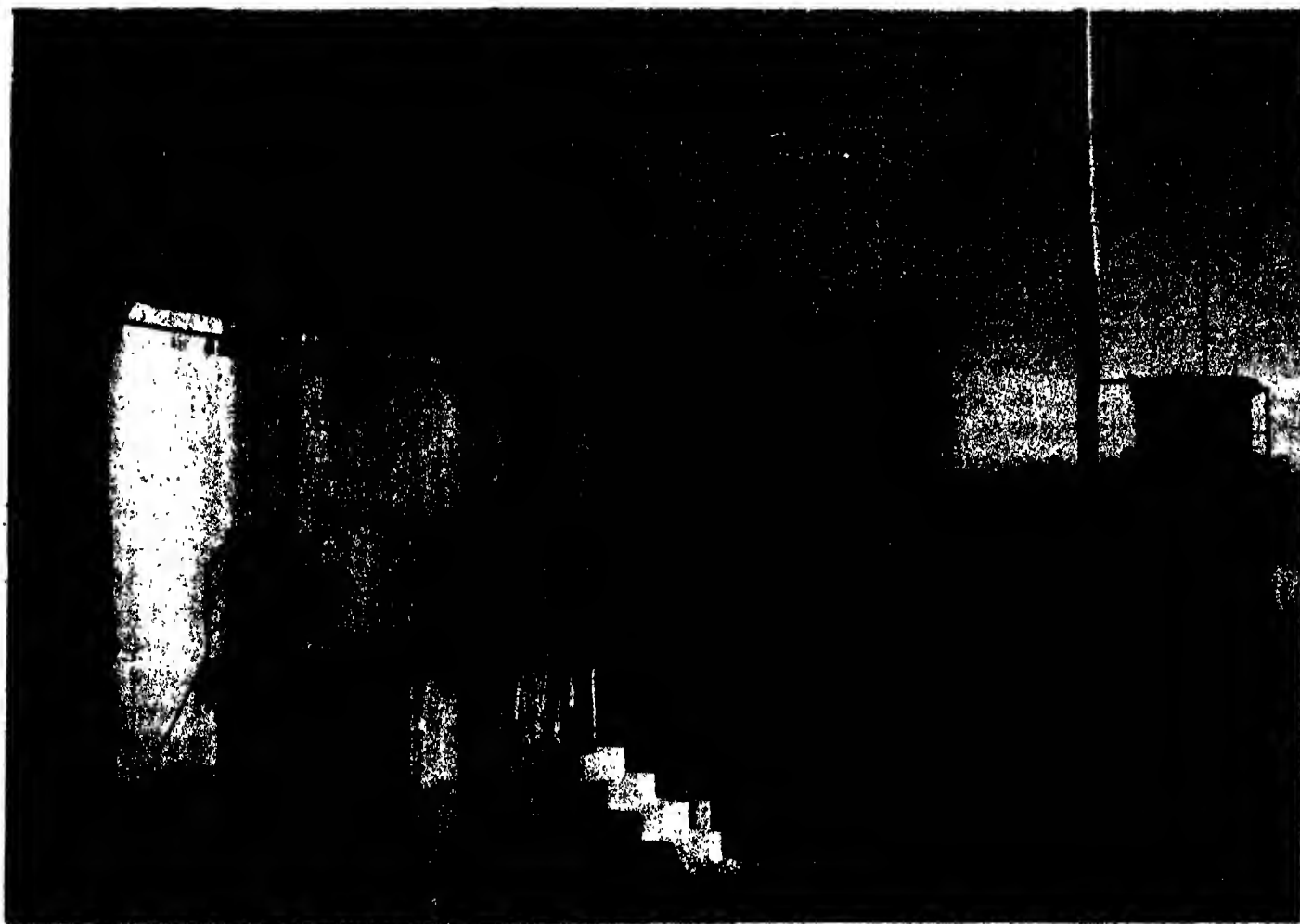


# CSIR NEWS



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While fulfilling its commitment towards the National & Societal Missions and CSIR Thrust Areas, NEERI-Hydrabad made significant contributions during 1989-90 in its R&D thrust areas, viz. environmental monitoring, environmental biotechnology, hazardous waste management, environmental systems design, modelling & optimization, environmental impact & risk assessment and environmental policy analysis (p.2). Shown here is pilot plant set up for biodegradation of distillery spentwash at the Polychem Distillery in Maharashtra

## **R&D Highlights: 1989-90**

The National Environmental Engineering Research Institute (NEERI), Nagpur, while fulfilling its commitment towards National & Societal Missions and CSIR Thrust Area Activities, made significant achievements, during 1989-90, in the RC-endorsed thrust areas of R&D, viz. Environmental monitoring; Environmental biotechnology; Hazardous waste management; Environmental systems design; Modelling and optimization; Environmental impact and risk assessment; and Environmental policy analysis.

### **SOCIETAL MISSIONS**

#### **Technology Mission on Drinking Water**

Since the launching of the Drinking Water Mission by the Government of India in 1986, the institute has assessed drinking water quality in 24 districts. During 1988, it also coordinated CSIR programme on Holological Approach to Water Mission in Barmer, Koraput, Sikkim and Nagpur districts. This project received scientific inputs from NGRI, CSMCRI, ITRC, SERC and NBRI as also from central and state government agencies. The assignment included hydrogeological investigations through remote sensing and geophysical surveys; identification of water sources; water quality assessment; treatability studies as a basis for the design of water purification systems; topographical surveys for engineering designs; development of software for dissemination of technology and O & M mechanisms; and community awareness programmes. The Department of Rural Development entrusted the institute with the task of coordination for the installation of 240 hand

pump attachable Iron Removal Plants (IRP) in Assam and 3 fill and draw type Defluoridation Plants (DP) in Gujarat. Installation and evaluation of 239 IRPs and 3 fill and draw type DPs was completed during the year and the plants were handed over to the state government agencies after ensuring their satisfactory performance. The remaining IRP plant was under the process of evaluation.

Water quality in Andaman and Nicobar Islands was monitored at 452 sites. These studies revealed that water at 51 sites warrants iron removal. Disinfection was suggested as a prerequisite for all water sources in view of the large-scale bacteriological contamination. Water quality was also monitored in Lakshadweep Islands at 750 sites. The analyses revealed problems of high 'total dissolved solids' (TDS) on south-eastern side of Bitra, and salinity problems in Chetlat, Kalpeni and Kiltron.

#### **Ganga Action Plan**

Launched in 1985, the Ganga Action Plan is being implemented through R&D inputs in the areas of water quality monitoring, water quality modelling, wastewater treatment and environmental impact assessment, provided by several research and academic institutions, CSIR laboratories, PHEDs, consultancy firms, and international and bilateral funding agencies.

NEERI is engaged in a 36-month study, since December 1988, on Impact Assessment of Ganga Action Plan on Public Health under the joint sponsorship of GPD and ICMR, and in collaboration with AllHPH, Calcutta. The study aims at evaluation of the benefits of the project vis-a-vis the costs, and identification of correc-

tive/supplementary measures, if deemed necessary. Varanasi and Nabadwip have been chosen as project sites in view of their religious and cultural significance. The study will also help in designing cost effective strategies for similar water quality management programmes in future.

### **CSIR THRUST AREA PROJECTS**

The institute, alongwith other CSIR laboratories, worked on Mines to Metals and Habitat (MMAH) Project at Lambidhar Mines, Dehra Dun, and Development of Lowcost/Alternative Building Material Technologies and Pollution Abatement Systems in Doon valley.

Air quality monitoring at Lambidhar and Banog mines revealed that the pollution from mining activities is within CPCB standards. Water quality assessment indicated that physico-chemical parameters and heavy metal concentrations fall within drinking water standards and recourse to chlorination would ensure potability of water. Water supply system for the residential colony was designed employing an optimization algorithm for branched water supply systems. Plumbing system for individual residential blocks was also designed.

Extensive source as well as ambient air quality monitoring was conducted in and around the Doon valley as well as Dehra Dun for assessment of pollution caused by flue gas emissions from various types of brick and lime kilns. A system was designed and installed to control particulate emissions from lime kiln at Paonta Sahib.

## NEERI's R&D THRUST AREAS

### Environmental Monitoring

The major areas that have emerged in the recent years in the domain of environmental monitoring relate to ozone layer depletion; greenhouse effect; and studies on chemical speciation, acidic deposition and biogeochemical cycles.

Analytical schemes for physico-chemical speciation of trace metals such as Cu, Pb, Cd, Zn, Cr and Hg in natural waters and treated industrial effluents have been developed by the institute as part of a DOE-sponsored project. Ultrafiltration techniques have been employed for classification of metals into total dissolved, labile, particulate bound, inorganically bound, and organically bound forms. The techniques were used in river water quality assessment at Varanasi and Nabadwip in EIA of GAP. Analytical schemes are being developed for speciation of metals in soils.

A simple, reliable, efficient and rapid method for elution and concentration of viruses from water samples was developed at the institute in an ICMR-sponsored project. The method provides recovery of over 95% viral particles against 40% in current standard methods and is less expensive in terms of chemical usage. The immunoassay and gene probe techniques are being evaluated for the detection of enteric viruses.

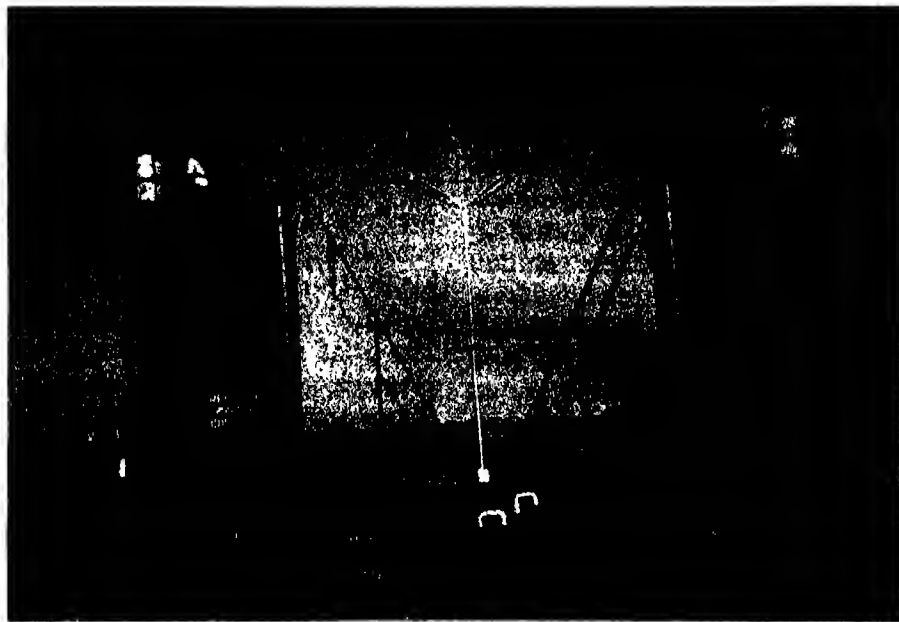
### Environmental Biotechnology

The thrust areas in environmental biotechnology include the application of biotechnology in environmental monitoring, restoration of environmental quality resource/residue/waste- recovery/utilization, treatment and substitution of non-renewable resources with renewable resources.

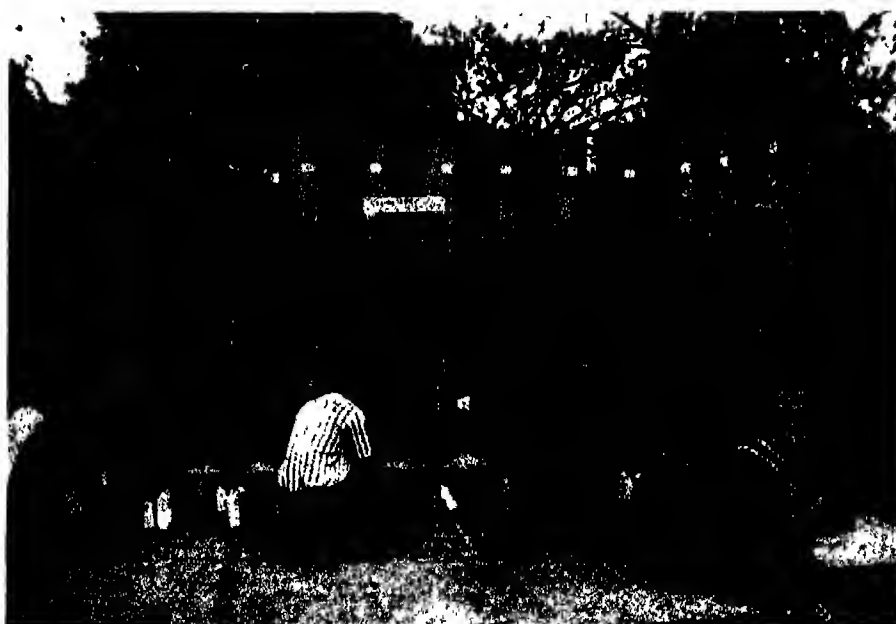
DNES-sponsored studies were completed on the diphasic

anaerobic activated sludge process to treat 20 m<sup>3</sup>/day distillery spentwash, in a pilot plant set up at Ulra, Maharashtra. The acid phase was operated at an OLR of 30 kg COD/m<sup>3</sup>/d. The methane phase in contact mode of operation reduced COD by over 80% at organic loading rates of 5 kg COD/m<sup>3</sup>/d with biogas produc-

tivity of 0.3 m<sup>3</sup>/kg COD utilized. Concomitant with the treatment, the process enabled recovery of usable energy amounting to over 13 times the energy consumed. Pilot plant studies on fixed film reactor technology for biomethanation of distillery spentwash are being carried out at WMDC distillery at Chitali, Maharashtra, as a



Defluoridation plant at Samadhilaya District, Bhavnagar



Lysimeter studies for land application of industrial waste water

sequel to the two-year long bench scale studies in a DNES-sponsored project.

Organic matter present in the municipal solid waste landfills facilitates biogas recovery to the tune of 350 m<sup>3</sup>/tonne of waste with 50-55% methane. Biogas recovery potential was demonstrated on pilot scale in a project sponsored by DNES at two sites of 8 ha each at Nagpur with 3 bores for biogas recovery per site.

The demand for low sulphur fossil fuels has been intensified by increasingly stringent regulatory standards for sulphur oxide emissions. Microbial desulphurization offers economically viable solution as cleaning of sulphur oxides from emission sources by physico-chemical methods is cost- and energy-intensive. Studies are in progress for sour gas desulphurization employing a two-stage chemo-biochemical process comprising chemical precipitation of elemental sulphur from hydrogen sulphide in presence of oxidant-ferric sulphur and biological regeneration of Fe<sup>+3</sup> using chemo-autotrophic bacterium *Thiobacillus ferrooxidans*. Also, a project is in progress under the Department of Biotechnology sponsorship to develop technology for cost effective recovery of 2,3-butanediol from water hyacinth on a laboratory scale.

Studies are being made for developing biotechnological processes for ethyl acetate and hydrogen production from a lignocellulosic substrate (congress grass), production of biosurfactants from carbohydrate rich waste and oily sludges, and photoproduction of hydrogen and treatment of organic wastes (whey/fruit processing) using photosynthetic bacteria, under DBT sponsorship.

### **Hazardous Waste Management**

There is now an increasing awareness on the quantity and diversity

of hazardous wastes generated by the industry and the risks posed to human health and environmental quality by the disposal methods in vogue for such wastes. This has prompted several countries to undertake effective technological, administrative, legal and policy measures to address the problem of hazardous waste management.

Studies have been undertaken at the institute on molten salt combustion technology to develop design criteria for the combustor and flue gas scrubber and recycle/disposal of molten residues. A bench scale molten salt combustor with a feed rate of 1.5 kg/h (pulverized solids) was designed, fabricated and installed. The trial runs revealed that air pressure and velocity through the furnace should be maintained at 2.5 kg/cm<sup>2</sup> and 6.8 m/s, respectively for salt destruction in 5 h. The process requires water and electricity at the rate of 1 litre/min. and 24 kWh/h respectively. Test runs were carried out to determine the efficiency of destruction of commercial pesticides like BHC and DDT, and on waste procured from IPCL, Baroda.

An area of 14 ha, was used by Union Carbide Industries Ltd. (UCIL) for solar evaporation ponds for toxic wastewater. The Government of Madhya Pradesh is planning to utilize this area for an industrial estate and residential buildings as a part of rehabilitation plan for gas victims. Investigation on the possible contamination of land and water environment in the nearby area to recommend remedial measures for decontamination of pond sediments before establishing proposed electronic industry complex in the pond area were completed by the institute under the sponsorship of Madhya Pradesh Pradushan Niwaran Mandal. Investigations revealed low chloride levels in the

water and land environment near the Solar Evaporation Plant (SEP).

Under MEF sponsorship, the institute prepared guidelines for siting of hazardous waste facilities and identification and management of abandoned hazardous waste sites. The guidelines are intended to assist the planners, regulatory agencies and industries in the selection of appropriate sites for location of hazardous waste treatment and disposal facilities. The guidelines would also assist in identification of abandoned hazardous waste sites for initiation of appropriate remedial action.

### **Environmental Systems Modelling and Optimization**

The mathematical problems in environmental management are of two types, viz. optimal planning and optimal control. Solutions to both warrant recourse to the techniques of systems analysis incorporating mathematical modelling and optimization. A substantial amount of research, supported by extensive monitoring, is required to develop well calibrated and validated mathematical models for air quality, surface and ground water quality, and ecological systems.

In order to take cognizance of lateral mixing arising out of transverse dispersion, a 2-dimensional water quality model was developed for wide rivers and was being calibrated for river Ganga at Varanasi. A numerical scheme based on Crank-Nicolson finite difference method for depth averaged 2-dimensional advective-diffusion equation for DO-BOD system was used. The work is being extended to incorporate lateral variations in river hydraulics parameters.

Studies are being made for the development and validation of computer simulation model for district planning with recourse to the systems ecology. The state variables and exogenous forcing func-



tions in the model correspond to real life components of an ecosystem; a feature generally absent in statistical models. The endeavour routes to the study of feedback and control loops, stability of the system and sensitivity of one component of the system to changes in other components. The model incorporating land, water, energy, material, ecologic and human subsystems could apply to answer the development related issues.

### **Environmental Impact and Risk Assessment**

EIRA studies undertaken by the institute included ranking of alternatives for selection of site, rapid EIA based on one season data collection, and comprehensive EIA based on 3 season data collection. The institute developed methodology for regional EIA and carrying capacity based developmental planning process. The methodology is proposed to be used in major industrial complexes as also in Doon valley and Narmada basin projects.

The Institute bagged a prestigious Rs 10 million project on Environmental Impact Assessment of nuclear power projects in Karnataka and Rajasthan. This challenging task, sponsored by the Nuclear Power Corporation is being undertaken for the first time in India.

A Policy Level Seminar on EIA was held at the institute on 2 February, 1990 as part of the Indo-Dutch Collaboration Programme. The seminar focused on the role of EIA in sustainable development as also project level case studies on environmental impact and risk assessment.

### **Environmental Policy Analysis**

The institute took up the task related to the preparation of Perspective National Environmental Plan (PNEP). PNEP analyzes the existing and future environmental issues

emanating from developmental objectives and policies in various economic sectors in India and suggests an agenda for action at the national level to ensure discernible positive movement towards the overall goal of sustainable development. It also identifies critical environmental issues and concomitant corrective actions in various economic sectors and presents priority areas of environmental action that need to be pursued at the policy, plan and programme levels.

Preparation of a comprehensive environmental management plan for Narmada basin development warrants a carrying capacity based systems study of all proposed projects in the basin. At the request of MEF and NCA, an overview proposal for establishing a Centre for Studies on Narmada Basin was

submitted by the institute in June 1989. The major objective of the proposed Centre is to delineate an action plan for environmentally compatible development of river based on carrying capacity study.

The galloping population pressure with concomitant developmental activities has rendered land environment to the status of a scarce resource with a number of competing demands such as agriculture, forestry, agroforestry, urban and industrial (including mining) development, transportation, and as sink for multifarious residues from human activities. A proposal for establishment of Centre for Studies on Land Environment was submitted to MEF in June 1989 to approach the problem in its holistic perspective, covering collection and collation of information on environmental im-



Floating laboratory  
for water quality  
monitoring

plications of sectoral land use plans; identification of R&D needs; development of mass communication programmes for public education, and devising policy pertaining to technological and organizational strategies for reversal of damaging trends in land environment.

### OTHER ACTIVITIES

A permanent exhibition depicting major R&D activities of the institute was inaugurated on 17 November 1989. The World Health Organisation took up mass production of Community Action Programme (CAP) kits designed by the institute in collaboration with IDC, IIT, Bombay. An Indo-Dutch Training Programme on Aquatic Ecotoxicology was held at the institute under the sponsorship of the National Institute of Public Health and Environment Protection, The Netherlands.

Know-how on physico-chemical and rapid bacteriological analysis kits was transferred to M/s. L. Tek, Nagpur.

The external cash flow for the institute during the year was Rs 37.17 million as against Rs 30.51 million in 1988-89 and Rs 17.46 million in 1987-88.

## Biotechnology in Tea

DR R. SINGH

Director, Tocklai Experimental Station, Jorhat

Tea is an important crop grown primarily in developing countries. It is currently grown in about 1.7 million ha of land, with an annual production of 2.3 billion kg; 60% of this comes from India, China and Sri Lanka. India alone accounts for about 30% of the total tea production.

The world demand of tea is estimated at about 3.2 billion kg by the turn of the century. Matching production can be achieved either

by planting more land with tea or by increasing productivity of the existing areas. Since additional land is not available for this purpose, as food crops claim priority over plantation crops in most developing countries, the only option left, therefore, is to increase productivity of the existing tea areas through rapid introduction of improved agrotechnology and superior planting materials. Biotechnology can contribute immensely to the development of better planting materials.

### Need for Research

Improved plants have been successfully produced so far by using conventional techniques of clonal selection, vegetative propagation and hybridization. But it can take up to 12 years to select/breed new plants by these techniques. Also full potential of the tea bush, which can theoretically produce up to 20,000 kg made tea per ha has not been realized. The maximum recorded yields today are about 8,000 kg made tea per ha. To break this yield barrier, biotechnology programmes have been initiated at most of the tea research centres. Since the potential is enormous, there is a need for intensifying efforts in this direction. An integrated approach for the plant improvement involving tissue culture, protoplast fusion and genetic engineering is essential.

Tissue culture can be used for large-scale multiplication of promising clones as well as for the selection of new clones. The most widely used method for isolating genetic variations by tissue culture is via callus cycle. Plants regenerated from callus culture can be highly variable in morphology, chromosome numbers, plant height, etc. Single gene variations have been reported in somaclonal variants which facilitate the selection of plants with desirable traits.

Isolation and regeneration of protoplasts, particularly in woody plants, is difficult and has been reported only occasionally from very few species. Selection of desirable plants can be achieved by somatic cell fusion. These have not been tried in tea. Production of haploid plants through anther, ovary and pollen cultures for pure homozygous lines is another area useful for breeding of superior clones.

Gene transfer through agrobacterium plasmids and electroporation can be used for introducing exogenous DNA directly into plant protoplasts. Genes for plant growth regulators for increased shoot production and for resistance to herbicides, for example, can be transferred for improved productivity.

### Current Status

There is no literature available on protoplast fusion or genetic engineering in tea. Attempts have been made for propagation of tea by tissue culture in Taiwan, Japan, China, Sri Lanka, USSR and India.

Regenerated plantlets from cotyledon callus and new clones have been tested in field conditions. Embryoids directly from cotyledon sections of tea seeds have also been produced. Adventitious embryos obtained from cultured cotyledons have shown interspecific and varietal differences in the rates of differentiation. Formation of pollen embryoids and callus from tea anther culture is also known.

Tocklai has produced multiple shoots from globular callus with adventitious embryos derived from matured tea embryos; 45% shoots formed roots on filter paper bridges. Efforts have also been made for micropropagation of tea plantlets. Regeneration of shoots from nodal explants, and shoot regeneration from shoot tips and nodal segments have been

reported. Rapid plantlet multiplication has been obtained from axillary buds, isolated embryos, shoot tips and nodal segments. Production of up to 10,000 to 100,000 plants per microcutting per year, through micropropagation, has been reported to be possible.

#### Scope for Further Work

Though the work has been initiated, a reliable tissue culture technology has not yet been evolved for the production of commercial tea clones. Genetic engineering research has not even started. Therefore, concerted efforts need to be made along the following lines:

1. Multiple shoot and root production from several tea explants has already been achieved but plant growth in the field conditions still remains major problem to be solved.

2. Somaclonal and protoclonal variations for selection of desirable plants should be exploited.

3. Protoplast isolation, regeneration and fusion technology can be used for transfer of desirable traits from one tea clone to the other by somatic cell fusion. Genetic transformation and protoclonal variation can also be achieved.

4. Somatic embryos can be used for development of artificial seeds in bioreactors, cryopreservation and clonal propagation of plants in large numbers.

5. Anther and pollen culture technologies are needed for production of haploid tea plants, which would be beneficial in producing pure homozygous lines.

6. Cell cultures need to be grown under controlled conditions for production of commercially important secondary metabolites.

7. Cryopreservation technology be developed for long term preservation of elite tea clones, somatic embryos, callus and cells.

8. Production of polyploids should be taken up as potential planting material.

9. Basic research is needed for identification of specific genes for flushing behaviour, flavour genesis and resistance to drought, diseases and pests.

#### Mutation Studies in *Solanum khasianum* Clarke

Shri Gandhi Ram of the Regional Research Laboratory, (RRL), Jammu, carried out mutation studies in *Solanum khasianum* Clarke by inducing mutations by X-rays, ethyl methane sulphonate (EMS) and sodium azide (SA). Seeds of two cultivars of *S. khasianum* were used for the mutagenic treatment in order to generate variability so as to select suitable mutants either for direct use or for use in future breeding programmes.

Screening of the M<sub>2</sub> and M<sub>3</sub> generations of segregating populations revealed sufficient variability. In all 42 mutants were selected which included 26 mutants from RRL-20-2 and 16 from RRL-S1-6. Further investigations were carried out in the M<sub>4</sub> and M<sub>5</sub> generations, in order to develop pure breeding lines having a stabilized genetic system. Comparative studies of the mutants were also carried out with the parent material.

Of the 42 mutants selected, 35 types were found to breed true to their characters. The mutants could be classified into different groups based on following characteristics — tall, dwarf, early maturing, late maturing, large leaf, less spined, prostrate, large berries, more berries (per plant and per bunch) and high solasodine content in berries. Six mutants were identified which had 4.5% solasodine content as compared to 2.5% in normal plants.

Shri Ram worked under the supervision of Dr B.L. Kaul, Head, Mutation Research Lab, RRL, Jammu, and was awarded Ph.D. degree by University of Jammu.

#### Mass Spectral Studies of Phenoxyacetyl and Phenoxypropyl Derivatives

Shri Urooj Ali Mirza of the Indian Institute of Chemical Technology (IICT), Hyderabad, carried out in detail the mass spectral studies of phenoxyacetyl and phenoxypropyl derivatives. The mechanism of loss of 'CO' on electron impact (EI) from substituted phenoxyacetates was investigated thoroughly. Based on collision induced dissociation (CID) study, diphenoxymethane structure for the (M-CO)<sup>+</sup> ion was proposed. The electron releasing groups were found to increase the intensity of (M-CO)<sup>+</sup> ion. The mechanisms proposed for the formation of this ion were supported by deuterium labelling studies. Also, ortho effect in the case of o-methoxy and o-nitrophenyl phenoxyacetates was studied. The structure of m/z=122 ion formed by the interaction of o-methoxy group was analyzed by linked scan and deuterium labelling studies. CID spectrum of m/z 122 ion was compared with that of the molecular ion of methylenedioxybenzene. Formation of ion at m/z 152 in the case of o-nitrophenyl phenoxyacetate as a result of o-interaction was discussed, and plausible mechanism was proposed for the formation of this ion involving one of the oxygen atoms of the nitro group in the rearrangement followed by the loss of phenoxy radical and 'CO'.

The mass spectral study of thiophenoxyacetyl derivatives was also carried out. The general decomposition pattern on electron impact of these derivatives was studied. In this series, two competing decomposition pathways

namely  $\alpha$ -cleavage and hydrogen transfer to the oxygen atom were observed to be the dominant processes. The mass spectral fragmentation of phenyl phenoxy acetates and phenyl thiophenoxy acetates well correlated with substituent constants.

Structure and mechanism of formation of  $(M-PhOH)^+$  ions from phenyl esters of phenoxy, thiophenoxy and anilino propionic acids were investigated by linked scan and deuterium labelling studies. 4-Chromanone structure was proposed for  $m/z$  148 ion formed from phenyl phenoxy-propionate. Structure of  $m/z$  164 ion from phenyl thiophenoxy propionate was investigated by comparing its CID spectrum with that of thiochromanone. The investigation ruled out the major contribution of structure of thiochromanone for  $m/z$  164. A four-membered ring structure involving sulphur atom was proposed for this ion. In the case of phenyl anilino propionate the ion at  $m/z$  147 corresponding to  $(M-PhOH)^+$  ion was studied by linked scan and D-labelling methods. CID analysis of  $m/z$  147 did not support the 1-(H)-hydro-2,3-dihydroquinolinone structure for this ion. Deuterium labelling studies showed that the NH hydrogen was also involved in the loss of phenol from this compound. A possible four-membered azetidione ( $\beta$ -lactam) as one of the contributing structures was proposed for this ion.

Shri Mirza also investigated the use of 1,2-dibromoethane as a positive ion chemical ionization reagent. The chemical ionization mass spectra (CIMS) of various geometrical acids and esters were studied. Protonation of *cis* isomers was found to be more favourable than *trans* isomers. The analysis of the CI spectra of these isomers showed striking differences between E and Z isomers. The E

isomers formed adduct with the reagent ion  $C_2H_4Br^+$  whereas Z isomers did not. Two mechanisms were proposed for the adduct ion formation.

The utility of this reagent was extended to study the site of electrophilic addition of  $(C_2H_4Br)^+$  ion to phenol. The ion-molecule reactions of this reagent gas with phenol were studied. The structure of the adduct ion was analyzed by linked scan studies. Comparison of the CID and MI spectra of 4-hydroxyphenethylbromide and 2-phenoxyethylbromide with the CID spectrum of adduct ion supported contribution of hydroxyphenethylbromide structure for the adduct ion, suggesting that the attack of reagent ion is more towards the aromatic ring.

Shri Mirza was awarded Ph.D. degree by the Osmania University for these studies. He worked under the guidance of Dr M. Valramani of IICT.

## **PROGRESS REPORTS**

### **RRL-Jammu Annual Report: 1988-89**

The Regional Research Laboratory (RRL), Jammu, carries out its R&D activities in the following areas: Drugs and Pharmaceuticals, Natural Products (cultivation, processing and chemistry), Biotechnology, Post-harvest Technology of Regional Agro-horticulture Produce, Edible Mushrooms, Utilization of Mineral Resources, Development of Backward Areas, Applied Biology, Processing of Sheep, Goat and Fur Skins, and Non-conventional Sources of Energy. The laboratory is also associated with the National Mission Project on Oilseeds, and the All-India Coordinated Project on Ethnobiology. The progress of some salient activities of the laboratory, during 1988-89, mentioned in its annual report, is indicated here:

Under its programme on Drug Development, a project was taken up for exploring new experimental models. Two new experimental models—propranolol-pretreated animal and  $CCl_4$ -pretreated animal for glucose tolerance test—were developed for testing hypoglycaemic activity. The hypoglycaemic effect recorded with these test materials is more sustained and is not reversed by compensatory mechanism of the body operative in normal animal.

Toxicity, pharmacological and biochemical studies were conducted on bioavailability enhancer compound piperine alone and the formulations rifampicine + piperine and propranolol+piperine. No indications of toxicity or other side effects were observed in treated animals. The solubility and shelf-life studies conducted on these formulations proved that piperine does not enhance the rate of degradation of rifampicine and propranolol in any way. On the contrary it seems to offer protection to the drug.

An exhaustive chemical examination of the oil of *Iphegenia stellata* resulted in isolation of some rare sterols, of which 7- $\beta$ -hydroxystigmasterol has been found to be a potent anticancer agent.

Fermentation with *Aspergillus niger* in a specially designed air lift fermenter with inner loop was studied under varying pressure and oxygen partial pressure conditions in collaboration with TCB-Dortmund (FRG). A particular circulating velocity, depicting an oscillation in dissolved oxygen, was discovered to influence the enzyme (glucose oxidase) build up and organic acid production. A patent on an improved process for the microbial production of fungal metabolites was filed in Germany; it was being also filed in India. A new and economical one-pot process (1 kg scale) was developed for the

manufacture of thymol from piperitone.

A citral-rich strain of *Ocimum americanum* was found during the general screening programme. This strain would be further investigated to develop an alternative source of lemongrass oil which is presently obtained from *Cymbopogon* sp.

Some success was achieved in the domestication of *Picrorhiza kurroa* in Srinagar. This plant grows naturally at very high altitude and is now an endangered species due to its ruthless extraction from its natural habitat.

*Salix* species introduced earlier from Czechoslovakia were further propagated and sixteen thousand plants were raised from stem cuttings for future supply to Field Research Laboratory at Leh for afforestation of Ladakh region.

A sponsored project on direct conversion of  $\alpha$ -pinene to  $\alpha$ -terpenyl acetate and  $\alpha$ -terpenol was taken up. A few bench scale experiments were carried out and 50-60% conversion was obtained. Attempts were being made to further improve the yield. Under the All India Coordinated Research Project on Ethnobiology, an inventory of plants of ethnobotanic significance was made, providing information on 325 taxa growing in north-west and trans-Himalayan regions. Ten new wild edible plants and 32 new ethnomedicinals were brought to light. The study also revealed the nutritional status of wild edibles, thereby highlighting the plant protein resources.

The Central Coir Research Institute retained this laboratory for design, fabrication and initial trials of a continuous board-making plant with coir felt reinforcement, gypsum binding and paper encasement. The laboratory had already developed technical knowhow for making gypsum boards on a small scale. A demonstration stall was designed and fabricated with these

boards in the exhibition, Vigyan Gaon Ki Aur, held at Gauri Ganj (U.P.) in March 1989. Similar stall from gypsum boards was assembled in the exhibition-cum-conference on 'Energy Saving in Industry' held in New Delhi.

Advisory consultancy was provided to M/s Hindustan Levers Ltd, for assessing the quality of raw materials and finished products (detergents) produced by them.

Two units located at Jammu were given consultancy for the production of ready-to-serve beverages and dehydration of mushrooms.

A condux toothed disk mill, procured from Germany, was commissioned in the laboratory. This mill would be used for the isolation of fibres by semi-chemical, hydrothermal pulping and dry fiberizing technique for laboratory and pilot scale studies.

A demonstration of the solar dryer for toria seed (capacity 600 kg toria seed per batch), designed, fabricated and developed by the laboratory was successfully conducted in the presence of representatives of the National Agricultural Marketing Federation of India Ltd, (NAFED), Haryana Cooperative Marketing Federation (HAFED), and Central State Farm, Ladhawal. The oil content, its colour, free fatty acids and germination of toria seeds dried in this dryer are not affected. The aflatoxins are also absent.

A practical demonstration of recovering wool and its utilization was given to the trainees of the Sheep and Sheep Products & Development Board.

Two workshops, one at Srinagar on 'Rabbit Fur Technology' and another at Jammu on 'Futurology of Pulp, Paper and Board Products' were organized during the year. Seventy-one papers and eight popular articles were published and 30 papers were presented.

## **CDRI Stall at National Technology Fair, Madras, bags Best Accomplishment Award**

A major National Technology Fair was organized by the Directorate of Industries and Commerce, Tamil Nadu, at the Anna University, Madras, during 25-28 October 1990. The Central Drug Research Institute (CDRI), Lucknow, participated in the fair at the invitation of the Industrial and Technical Consultancy Organisation of Tamil Nadu Limited, by setting up a stall displaying its R&D activities.

The objective of the fair was to bring together technology seekers and offerers. CDRI provided on-the-spot facility to the interested industrial concerns/entrepreneurs for signing of secrecy agreements under which technology seekers could evaluate published and unpublished data generated at CDRI on 'New Products/Drugs & Technologies', before entering into an agreement with the institute for obtaining licence under sponsored/collaborative arrangements.

At the stall, CDRI scientists explained the institute's technologies and presented demonstrations of the iodine detection kit and filariasis diagnostic kit. A lecture was also delivered for the benefit of delegates.

At the fair, the institute signed two secrecy agreements: one on Picroliv (a hepatoprotective agent) from *Picrorhiza kurroa* and clofazimine-dapsone combined dosage tablet (antileprotic formulation) with M/s Chemech Laboratories Ltd, Madras.

Many other parties also expressed their interest in commercialization of CDRI technologies, such as gugulipid, centbucridine, iodine detection test paper, palatable laxative, centimilzone, paracetamol, trimethoprim, d-propoxyphene HCl, etc.



In recognition of the fulfilment of the aim of the fair leading to signing of agreements (between CDRI and Chemech Laboratories Ltd, ITCOT gave a 'Special Award' to CDRI stall for best accomplishment in 'Technosource' 1990. The award carries a citation and a shield.

The following CDRI Officers participated in the fair: Dr J.C. Katiyar, Dr Rajendra Prasad, Shri Pradeep K. Srivastava and Shri Ali Kausar. A special pamphlet 'Technical Information & Industrial Liaison' was published on this occasion.

### **CSIR participates in India International Trade Fair 90**

CSIR participated in India International Trade Fair, held during 14-23 November 1990 at Pragati Maidan, New Delhi, and displayed its activities related to the following themes: Societal Missions—Water and Wasteland; Drugs for all in 2000; High Science Capabilities; Success Stories and Science for Masses. The laboratories whose technologies were displayed include: CSMCRI- Bhavnagar, NGRI and IICT-Hyderabad, RRL-Jammu, CFB-Delhi, NCL- Pune, NAL-Bangalore, SERC-Madras, CMRS and CFRI-Dhanbad, CDRI and CIMAP-Lucknow.

More than a lakh of people comprising students, young entrepreneurs and others visited the CSIR part of the fair. The exhibits on in vitro coaxing of bamboo, rose oil extraction, jajoba cultivation, mushroom culture and gugulipid evoked great interest among the visitors. A delegation comprising scientists and technologists from the Scientific Research Organization, Italy, also visited the CSIR display and expressed their interest in CSIR technologies.

## **TRAINING COURSES**

### **Training Programme on FRP Building Materials at CGCRI**

The first training programme on FRP Building Materials and Other FRP Components, under the 35 Point Action Plan of CSIR, was held at the Central Glass & Ceramic Research Institute (CGCRI), Calcutta, during 27-30 August 1990. Dr B.K. Sarkar, Director, CGCRI, inaugurated the programme. In his address, he highlighted the use of FRP in lowcost housing and building materials. Describing the need of housing as one of the most pressing demands of the country in general, and for the economically weaker sections of the society in particular, he opined that lowcost alternative building materials like FRP are the possible solutions of the present acute housing problem. He hoped that the successful implementation of the training programme and dissemination of information to the entrepreneurs would help in employment generation and a new awareness in the entrepreneurs.

He said that the training in FRP building materials would be a continuing process and the Composite Division of CGCRI would always be willing to render all possible assistance in setting up FRP units.

Thirty-two trainees attended the training programme. The raw material required for training was supplied by M/s CEAT Ltd, Calcutta, M/s Bakelite Hylam Ltd, Calcutta and M/s Thermoplast, Calcutta.

### **Training Programme on Appropriate Technology for Rural Development through Coastal Aquaculture**

A two-week training programme on Appropriate Technology for Rural Development through Coastal Aquaculture was conducted at the Regional Centre of the National Institute of Oceanography, Cochin, between 16 and 29 August 1990. This was the first in the series of Training Programmes undertaken by the laboratory as part of the Government of India Action Plan for S&T Sector, being implemented by CSIR.



A practical demonstration during training programme on FRP building materials at CGCRI, Calcutta



Ten trainees (5 men and 5 women, including three SC/ST) having SSLC as minimum educational qualifications and age below 30 years, were selected for the programme, from Pallipuram, a coastal village in Ernakulam District. The curriculum essentially comprised theoretical and practical studies in general biology, ecology, physiology of cultivable organisms, culture and management techniques of traditional and modern aquaculture farms with special emphasis on prawn culture. Physico-chemical and biological environment of culture systems, formulation and preparation of compounded diets, feeding, monitoring of growth, weeding and control of predators, harvesting and post-harvest technology were the topics dealt with in 19 lecture classes, 7 practical classes and 4 field demonstrations.

An important feature of this programme was the know-how imparted to the trainees on the utilization of resources wasted in rural areas for want of awareness of their potential for aquaculture. The course was inaugurated by Shri C.T. Sukumaran, IAS, Chairman, MPEDA. Certificates were distributed to the trainees by Shri K.R. Rajan, IAS, District Collector, Ernakulam, at the valedictory function. Dr V.N. Sankaranarayanan, Scientist-in-Charge, NIO Regional Centre, presided.

Dr U.K. Gopalan, Scientist, was the co-ordinator of the programme.

## **DEPUTATION BRIEFS**

### **Dr D. Atchuta Rao**

Dr D. Atchuta Rao of the National Geophysical Research Institute, Hyderabad, was deputed to Australia from 12 to 27 September 1990 to present an invited paper entitled 'Aeromagnetic expression of dyke swarms in some parts of

India and their evolution in relation to structure and tectonics' at the 2nd International Dyke Conference held at Adelaide from 12 to 15 September. He also chaired the session on 'Crustal tectonics of Antarctica and India'.

Dr Rao also participated in a workshop on 'Processing and interpretation of magnetic surveys flown near the magnetic equator' at Adelaide during 24-27 September. The discussions brought to focus the complexities in magnetic anomalies in areas (0 to 50°) of low magnetic inclinations and the need to process them using reduction to pole technique and the limitations of their utility in very low inclination areas.

At the workshop, Dr Rao highlighted the complexities in the anomalies of the surveys flown in India near low latitudes quoting examples from the Cuddapah Basin, Chitradurga, Kudermukh and South India aeromagnetic maps.

### **Shri P.K. Ranjekar**

Shri P.K. Ranjekar, National Chemical Laboratory (NCL), Pune, was deputed to Cornell University, New York, USA, during June-September 1990 to get acquainted with the current concepts in plant gene structure and gene expression and to learn the latest working protocols in recombinant DNA technology.

### **Shri A.K. Bhatia**

Shri A.K. Bhatia, Regional Research Laboratory, Jammu, was deputed to Bulgaria during 27-August-1 October 1990 for exchange of information on dietetic food processing and post-harvest technologies for temperate fruits. He visited the Canning Research Institute, Plovdiv and several fruit and vegetable processing industrial units in Plovdiv, Yambol,

Altos, Assenovgrad, Sofia and Stamboliski.

## **Honours & Awards**

### **Prof. D.V. Singh**

Prof. D.V. Singh, Director, Central Road Research Institute, New Delhi, has been awarded the Khosla Research Prize (1990-91) under the Khosla Research Awards and Prizes Scheme of the University of Roorkee, for his outstanding paper entitled: Elastothermohydrodynamic Effects in Elliptical Bearings, published in *Wear*, V. 118, 1989.

The award carries a cash prize of Rs 1,000 and a silver medal.

### **Dr A.C. Sarna, Shri Ravi Prakash and Shri H.H. Suthar**

The above scientists of the Central Road Research Institute, New Delhi, and Shri V.G. Mulay, Ex. Superintending Engineer, PWD, Bombay, have been jointly awarded commendation certificate by the Indian Roads Congress, (IRC), for their paper entitled: Grade Separated Road Interchanges for An Urban Arterial System, published in *Highway Research Bulletin*, No. 37 (1989), of IRC.

### **Prof. K.A. Thaker Award for IICB Scientists**

The paper entitled 'A novel thickener for the textile printing from the leaves of *Litsea polyantha*, by N. Banerji, K.K. Sarkar and R. Bose of the Indian Institute of Chemical Biology (IICB), Calcutta, published in the *Journal of the Institution of Chemists (India)* [61: III May 1989, 77-78], has been chosen for the Prof. K.A. Thaker Award for 1989 for being the best paper of the journal during 1989.

**Dr S.N. Kak and Dr B.L. Kaul**

Dr S.N. Kak and Dr B.L. Kaul of the Regional Research Laboratory (RRL), Jammu, have been jointly given the Dr Sadgopal Memorial Award for the year 1988 by the Essential Oil Association of India, for their paper entitled 'Radiation induced mutations in *Mentha citrata*' published in *Indian Perfumer* 32(2) 1988.

In the award-winning paper, the authors have reported their research work regarding application of  $\alpha$  - and  $\gamma$  - rays for the genetic improvement of *Mentha* species. Economically useful mutant clones of *M.citrata* have been developed by employing this technique.

**Dr P. Pushpangadan**

In the General Body meeting of the International Society of Ethnobiology held at Kunming (China) on 24 October 1990, Dr P. Pushpangadan of RRL-Jammu, has been elected a member of the Board of Directors for a term of two years from November 1990. He was also elected Treasurer of the Society.

Dr Pushpangadan has also been appointed Director of Tropical Botanical Garden and Research Institute, Palode, Trivandrum (Kerala).

**Shri A.K. Shahi**

Shri A.K. Shahi of RRL-Jammu, has been nominated Editor of *Current Agriculture* by the Indian Society of Salinity Research Scientists, for a period of three years.

## **PATENTS FILED**

764/DEL/90: An electronic device for high speed peer to peer data communication, K.C.S. Murty, S.S. Saini, R.S. Shekhawat, S.K. Dixit, T.R. Ranjan Sharma - Central Electronics Engineering Research Institute, Pilani.

836/DEL/90: A process for the production of short ceramic fibres of  $\alpha$ -Al<sub>2</sub>O<sub>3</sub> and nitrides of aluminium and silicon, C.B. Raju, J. James and T.C. Rao - Regional Research Laboratory, Bhopal.

837/DEL/90: An improved process for the preparation of 1,2,3,4,5,6,7,12,12a-octahydropyrazino (2',1':6,1) pyrido (3,4-b) indole, K. Bhandari, S.K. Chatterjee - Central Drug Research Institute, Lucknow.

838/DEL/90: An improved process for the production of steam by burning bagasse, H. Singh, S.M. Sharma, C.R. Prasad - Central Electronics Engineering Research Institute, Pilani.

839/DEL/90: An improved process for the preparation of cadmium free silver base alloy for use as electrical contacts, P. Basak, S.C. Dev, R.K. Dubey and O.N. Mohanty - National Metallurgical Laboratory, Jamshedpur.

840/DEL/90: Improvements in or relating to the process of production of tabular alumina, K. Ray and K. Gupta - National Metallurgical Laboratory, Jamshedpur.

864/DEL/90: Improvements in or relating to electrocoating of epoxy ester resins on mild steel and aluminium, P. Jayakrishnan and S. Guruviah - Central Electrochemical Research Institute, Karaikudi.

865/DEL/90: A process for the production of cyclohexanone oxime, J.S. Reddy, S. Sivasanker and P. Ratnasamy - National Chemical Laboratory, Pune.

866/DEL/90: A process for the preparation of an amorphous sodium aluminium silicate powder useful as property enhancer in filled composition, D.B. Shukla, P.C.M. Oza, V.M. Sheth and V.P. Pandya - Central Salt & Marine Chemicals Research Institute, Bhavnagar.

868/DEL/90: A process for the

synthesis of 2-(RS)ciano p-substituted benzyl (±)-cis-2, 2-dimethyl-3-(2,2-dichlorovinyl) cyclopropane carboxylates, new potent insecticides belonging to synthetic pyrethroid group, G.H. Kulkarni, D.G. Panse and R.H. Naik - National Chemical Laboratory, Pune.

## **ANNOUNCEMENTS**

### **International Symposium on Newer Trends in Essential Oils and Flavours**

The Regional Research Laboratory (RRL), Jammu, is organizing an International Symposium on Newer Trends in Essential Oils and Flavours, at Jammu. The symposium, to be held during 21-23 October 1991, will include plenary lectures and contributed papers on the following topics, grouped in four areas:

**Chemistry:** Development of new sources, Proper utilization of conventional sources, Modification of available organic constituents from plant sources, and Newer methods of analysis.

**Botany** (including agriculture): Identification and exploitation of new plant sources, Improvement of existing materials and Modern techniques of cultivation.

**Biotechnology:** Tissue culture of essential oil bearing plants, Fungal sources of essential oils, and Microbial transformation of terpenoids.

**Chemical Technology:** New techniques for the isolation and purification of essential oils and preparation of isolates.

The last date of registration for the symposium is 31 January 1991. Further details regarding the symposium can be had from: Dr K.L. Dhar, Organizing Secretary, ISNTEOF RRL-Jammu 180001.

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# CSIR NEWS



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Prime Minister Shri Chandra Shekhar presented the Shanti Swarup Bhatnagar Prizes for 1989, on 10 January 1991, at a function held in New Delhi. Here he is seen with some of the prize-winners, Dr A.P. Mitra, Director General, CSIR and Dr S.K. Joshi, Director, NPL

## IN THE ISSUE

International Symposium on Optical & Radio Remote Sensing of the Atmospheric Environment	... 15
Second National Conference on Electrochemicals	... 17
Indo-USSR Collaborative Project on Trans Indian Ocean Geotraverse Studies	... 18
NBRI celebrates its Annual Day	... 20
Portable Optical Methanometer	... 20

CGCRI Annual Report: 1988-89	... 21
Advanced Course on Analysis and Design of Transmission Line Towers	... 24
Dr A.P. Mitra awarded INSA C V. Raman Medal	... 24
Dr B.K. Bachhawat awarded INSA Shanti Swarup Bhatnagar Medal	... 24

## Prime Minister presents Shanti Swarup Bhatnagar Prizes for 1989

Prime Minister Shri Chandra Shekhar, who is also the President of CSIR, presented the Shanti Swarup Bhatnagar Prizes for 1989 to ten scientists for their excellent contributions in science and technology, at a function held in the National Physical Laboratory, New Delhi, on 10 January 1991.

The award-winning scientists are: Prof. S.C. Lakhotia, Department of Zoology, Banaras Hindu University, Varanasi and Dr Manju Ray, Department of Pharmacy, Jadavpur University, Calcutta — Biological Sciences; Prof. S. Chandrasekaran, Department of Organic Chemistry, Indian Institute of Science, Bangalore and Prof. M.K. Chaudhuri, Department of Chemistry, North-Eastern Hill University, Shillong — Chemical Sciences; Dr P.C. Pandey, Space Applications Centre, Ahmedabad — Earth, Atmosphere, Ocean & Planetary Sciences; Dr Srikumar Banerjee, Physical Metallurgy Division, Bhabha Atomic Research Centre, Bombay and Dr G. Venkateswara Rao, Structural Engineering Group, Vikram Sarabhai Space Centre, Trivandrum — Engineering Sciences; Prof. Gopal Prasad, Tata Institute of Fundamental Research, Bombay — Mathematical Sciences; and Prof. M. Lakshmanan, Department of Physics, Bharathidasan University, Tiruchirappalli and Prof. N.V. Madhusudana, Raman Research Institute, Bangalore — Physical Sciences. No award was given in the field of Medical Sciences.

Each awardee was presented with a cash prize of Rs 50,000, a citation and a memento.

Addressing the distinguished gathering of scientists, Shri Chandra Shekhar said that the Indian scientific community has done well despite the lack of proper



Shri Chandra Shekhar addressing the scientists

facilities and infrastructure. "The Nation is proud of you and you are the hope of the Nation".

Referring to the Gulf crisis, he said that the S&T developments can be constructive as well as destructive. But if these are used for destructive purposes, it is because of the ambitions of a few politicians. He called upon the scientists to use modern scientific developments for the service of the people. "But while involving yourself in prestigious and competitive research, you must try not to ignore the ground realities. And ground realities centre round poverty". "Poverty does not necessarily imply just money. India is not poor in natural resources or in fertile soil or in manpower. It basically lacks the synthesis of the human labour available and its resources", the Prime Minister remarked.

Underscoring the need for restoring a sense of confidence and participation in the rural and tribal populace, Shri Chandra Shekhar said that though Punjab, Jammu

& Kashmir and Assam are political problems, people from Tripura to Tamil Nadu, particularly rural and tribal, are apprehensive that they have been deprived of the benefits of development. The development has been 'lop-sided' — the society has grown in such a manner that a large section of people has been neglected. This has created an atmosphere of unrest and violence.

"A country that was once a leader in philosophy, knowledge and science is today badly affected in terms of knowledge. Today, we have 65% illiteracy and by the turn of the century we will have 52% of the entire illiterate population of the world. It is a matter of shame and concern", Shri Chandra Shekhar pointed out. He urged scientists to go into the vast field of 'human laboratory' and work towards amelioration of illiteracy, superstition and lack of medical and communication facilities.

"On one hand we are launching satellites, on the other hand we lack an effective communication network. An Aryabhata goes

around the world, but telephonic communication between South Delhi and Pusa Institute is a problem", he said in a lighter vein.

Reiterating that science will not be allowed to suffer due to the resource crunch, the Prime Minister remarked, "But if the benefits of scientific achievements do not cover all the people of the society then it is a failure of the democratic set-up".

Earlier, in his welcome address, Dr A.P. Mitra, FRS, Director General, CSIR, said that of the 237 recipients of the Bhatnagar prize since its inception in 1958, only five have settled abroad and most of the others have helped in building of institutions of excellence in their respective fields. The prize is given to scientists below 45, that is



Prof Gopal Prasad receiving the Bhatnagar Prize for Mathematical Sciences

when they are at the peak of their research career, and recognition at this stage is bound to encourage them in their future accomplishments. He said that the prize which has come to be recognized as the Nobel Prize of India, has proved to be a major incentive for the country's scientific community.

The citations of the awardees were published in *CSIR News*, 40(1990), 221. Accounts of the award-winning works will be carried in the forthcoming issues of the CSIR newsletter. □

## International Symposium on Optical & Radio Remote Sensing of the Atmospheric Environment

An International Symposium on Optical & Radio Remote Sensing of the Atmospheric Environment was held at the National Physical Laboratory (NPL), New Delhi, during 24-26 October 1990; it marked the conclusion of the Prof. S.K. Mitra Birth Centenary Celebrations — Prof. Mitra was born on 24 October 1890. The symposium was sponsored by INSA, CSIR, UGC, ISRO, DOD, IMD, IIA and NPL.

Prof. M.G.K. Menon, the then Minister for State of Science and Technology, inaugurated the symposium. A special issue of *Indian Journal of Radio & Space Physics*, dedicated to Prof. Mitra, was released by Prof. U.R. Rao during the inaugural function. As many as 217 papers were presented, which included some 20 papers from foreign countries like UK, USA, FRG, Bulgaria, Peru, Sweden, USSR, China and Japan. From India, almost all the institutions engaged in research in this field participated. These institutions are NPL, PRL, IIG, IIA, IITM, IMD, TIFR, IISc, IITs, RAC, AIR, and different research centres under ISRO, Ministry of Defence and DOE. Apart from these, there was a sizeable participation from universities and colleges. It may be mentioned that the participation from the Institute of Radiophysics and Electronics, Calcutta University, Calcutta, which was the working place of Prof. Mitra, was perceptibly significant. Twelve young scientists were awarded the Prof. S.K. Mitra Symposium Fellowships to attend this international symposium.

Fifty-five papers were selected for oral presentation in 9 technical sessions. Rest of the papers were included in two poster sessions.

Closing remarks were made by Dr A.P. Mitra, FRS, Director General, CSIR, in the last session. The oral sessions dealt with the following topics: (1) Optical remote sensing of the atmospheric environment, (2) Radio remote sensing of the atmospheric environment, (3) Radiometry, (4) MST radar, (5) Gravity waves and wave motions in lower atmosphere, (6) Atmospheric scintillation/satellite beacon, (7) Ionospheric physics/magnetosphere planetary atmosphere, and (8) Atmospheric chemistry and ozone.

The first two sessions were on optical remote sensing of the atmospheric environment. Presentations included description of the use of bistatic CW argon ion lidar (an acronym for light detection and ranging) system for the study of the nature of vertical mixing processes in the lower atmosphere during different seasons at Pune. Various uses of lidar like the study of atmospheric waves in the stratosphere and mesosphere, Raman lidar which uses wave length shifted scattered signals for the study of the atmospheric pollutants were also discussed. Experimental set-up was described at length for the study of scintillation pattern for understanding the various phenomena connected with optical communications, alongwith the measurement techniques for scintillation variations and preliminary results of a detailed programme involving a methodology for correcting satellite received radiances for atmospheric effects using ground based measurements of aerosol properties and reflected radiances.

The second session covered radio remote sensing of the atmos-

pheric environment. Subjects discussed included utilization of the Indian domestic satellite INSAT-1B data and data collected by other satellites for weather predictions like the use of INSAT derived data on lower level winds during the onset of summer monsoon, the analysis of the observation through INSAT-1B during different phases of evolution of Bay of Bengal cyclone in May 1990, techniques developed for making sounding data retrieval from satellite measured radiance which provides an important tool to get upper air information from vast oceanic areas required to monitor and track the prominent weather systems like tropical storms and Indian summer monsoon. Different techniques were also explained for extracting the appropriate parameters automatically from grey scale digital vertical incidence, oblique incidence and back scatter ionogram for providing online input of current sounding data into the ionospheric prediction scheme.

The third session was on Radiometry. Presentations were made on the application of microwave radiometry in the earth resources and atmospheric research; ground based radiometry for monitoring the temporal variations of water vapour, other dynamics and atmospheric activities; and space borne microwave for remote sensing for terrestrial applications. Detailed studies on various remote sensing satellites launched by different countries including India during 1960-1981, the significant developments in this field during 90s and microwave radiometer techniques as adopted by NPL for communication purposes, presented during this session, were very interesting. It was also disclosed that efforts were being made for making a fully automatic microwave imaging system having the capability of remote sensing for



Prof M.G.K. Menon inaugurating the International Symposium on Optical & Radio Remote Sensing of the Atmospheric Environment

mapping strategic field locations under night cover.

The realization that it is possible to explore the entire middle atmosphere by means of high power VHF radar has led to the concept of an MST radar. In the fourth session, various aspects of MST radar, like the electronic beam steering scheme proposed to be adopted for the currently installed Indian MST radar, techniques and system hardware and software, and its potential for studies on middle atmospheric dynamics were discussed at length.

The fifth and ninth sessions were poster sessions, displaying about 70 and 69 papers, respectively, dealing with almost all aspects of optical and radio remote sensing of the atmosphere.

The sixth session dealt with gravity waves and wave motion in the lower atmosphere. The papers presented an appreciation of the use of VHF, UHF radars in the field of atmospheric research. The electromagnetic observations in the form of atmospheric as recorded over Calcutta together with the synoptic situations and radar pictures in association with the sea-thunderstorm over Bay of Bengal, were also presented.

The seventh session was on ionospheric scintillation satellite beacon. Presentations were made on measurement of the vertical as well as east-west drift of the equatorial ionospheric irregularities by the spaced receiver method at Calcutta during solar maximum phase 1989-90. Combination of theoretical and numerical simulation methods with the support from data from ionosondes, HF Doppler, VHF backscatter radars and rocket and satellite observations were discussed for the understanding of the F-region plasma irregularities.

The eighth session was devoted to ionospheric physics/magnetosphere/planetary atmosphere. The papers presented various advancements made in the study of the upper atmosphere, especially with the advent of space age with satellite and rocket capability. Among the topics discussed were the experimental arrangements in the study and analysis of the upper atmosphere results and the reports of the study of the behaviour of positive ion composition under normal and artificially heated conditions in a model ionosphere, and the ter-diurnal oscillations on the wind in the meters-zone using the



data on the diffusion of meteor trails.

The tenth session was on atmospheric chemistry and ozone. The papers presented mostly concentrated on global climate and study of the minor constituents of the atmosphere. Discussions were held on the analysis of the data of solar UV-B radiation measurements done during Antarctic expeditions.

In his closing remarks, Dr A.P. Mitra summed up the symposium proceedings outlining future direction of research in the relevant topics. He also released the issue of *Vayu Mandal* dedicated to Prof. S.K. Mitra.

A book containing the extended abstracts of all the papers presented in the symposium was brought out and distributed to the delegates. □

## **Second National Conference on Electrochemicals**

The Second National Conference on Electrochemicals, organized by the Society for Advancement of Electrochemical Science and Technology (SAEST), in collaboration with the Central Electrochemical Research Institute (CECRI), Karaikudi, was held at the Indian Institute of Technology (IIT), Bombay, during 26-28 October 1990.

Welcoming the participants, Prof. K. I. Vasu, President, SAEST and former Director, CECRI, referred to the various activities of SAEST. He also mentioned about the lacuna in power sector and suggested that electrochemical industry being power intensive, should resort to night shifts and strive to get uninterrupted power supply at least during night.

Prof. S.K. Rangarajan, Director, CECRI, inaugurated the conference. In his address he remarked that the rise or fall of a nation is related to the technologi-

cal advancement it makes. He said that while the developed countries like USA spend 5-9% of GNP on S&T, India spends just 0.9% of GNP. Even Korea spends 1.8% of its GNP on science & technology. He also focused attention on the need to carry out research in the frontier and emerging areas.

Prof. A.P. Kudchadker, Deputy Director, IIT, Bombay, while releasing the souvenir brought out on the occasion, mentioned that three departments of his institute, viz. Chemistry, Chemical Engineering and Metallurgy, are currently doing research in electrochemistry.

Prof. K.S.V. Santhanam, Chairman of SAEST's, Bombay Chapter, gave the felicitation address in which he quoted extensive statistical data on various electrochemical products, and stressed on the importance of the subject.

Prof. N.S. Rengaswamy, Secretary, SAEST, while proposing the vote of thanks, dealt with the future programme of the society with regard to strengthening of the local chapter activities, forthcoming conferences, associateship examination, etc.

The conference was attended by about 80 delegates representing industry, academic and R&D institutions; 50 research papers were presented in four technical sessions.

### **Technical Sessions**

The session on technological aspects began with an invited lecture by Prof. C.K. Mital of the Chemical Engineering Department of IIT, Bombay. He dealt with the modern concepts in designing electrochemical reactors for production of chemicals. This was followed by presentation of ten contributory papers highlighting the recent trends in cell design and pilot plant studies for inorganic and organic electrochemicals. Some interesting case studies were also presented. Shri P.M. Jadhav,

M/s Excel Industries Ltd, Bombay, spoke on white phosphorous technology. This session was chaired by Dr K.C. Narasimham, Head, Electrochemical Division, CECRI.

Prof. R.A. Misra, Banaras Hindu University, Varanasi, in his lecture brought out the importance of the use of superoxide generated in situ in electrochemical reactions for transformation of various useful organic compounds.

The session on Inorganic Chemicals began with an invited lecture by Dr K.C. Narasimham. He highlighted the opportunities for inorganic electrochemical production. This session had ten contributory papers on the subject: inorganic electrochemical production strategies. The session was chaired by Prof. M. Sharon, Chemistry Department of IIT, Bombay.

The session on Chlor-alkali/Speciality Chemicals commenced with an invited talk by Shri S.Krishnamurthy, CECRI, who gave a detailed presentation on the recent advances made at CECRI in Membrane Cell technology. The session had papers on modelling studies, materials consideration in chlor-alkali industry and H<sub>2</sub> production. This session was chaired by Prof. C.K. Mital, Chemical Engineering Department of IIT, Bombay.

Prof. M.M.Taqi Khan, Director, CSMCRI, Bhavnagar, while giving a plenary lecture unfolded the exciting opportunities existing in the Photocatalysis with special emphasis on the use of semiconductor particulate systems.

The session on Organic Chemicals began with an invited lecture by Dr V. Krishnan, CECRI, who stressed the prospects of carbon electrochemistry for organic chemical production. Prof. K.S.V. Santhanam, TIFR-Bombay, in the next invited lecture, highlighted the manoeuvrability of electropolymerization for achieving

superior conducting polymers as futuristic materials. This session had eleven contributory papers highlighting the recent strategies in organic electrosynthesis. This session was chaired by Prof. V.G. Gurjar, Chemical Engineering Department, IIT, Bombay.

### Panel Discussion

Panel discussion was held on the various problems facing the electrochemical industry. Prof. K.I. Vasu chaired the panel meeting and suggested the following issues for discussion: (a) R&D for energy conservation, (b) Industrial policy (export/import of chemicals, excise duty, sales tax exemption, tariff rate, uninterrupted power supply), (c) Areas needing government support, (d) Interface between R&D and academic institutions, (e) Interface between research and industry, and (f) Smooth and efficient transfer of technologies.

Dr K. Balakrishnan, Deputy Director, CECRI, read out the view points received from the National Rayon Corporation Ltd, Thane.

Prof. Taqui Khan emphasized on energy auditing. He suggested that R&D efforts should be focused towards development of membranes for effluent treatment, substitute membrane for Nafion, fluorinated type membrane, etc.

Dr Balakrishna Tejam referred to pollution control as a major problem and opined that solvent extraction technique is the preferred route for ultrapure chemicals.

Shri T. Sushil Kumar Rajan, Chemplasta, Mettur Dam, felt that there is utmost need to develop indigenous ion exchange resin for mercury removal and hardness removal in sodium chloride brine. Electrochemical reduction of CO<sub>2</sub> was also mentioned. He also pointed out that chlorine is slowly losing its potential and now fluorine generation is gaining ground.

Prof. K.S.V. Santhanam of TIFR, Bombay referred to recovery of scarce metals and recovery of organic materials from waste through electrochemical route. According to him, ion sensors and molecular sensors have futuristic application.

Prof. C.K. Mital, IIT, Bombay, suggested that incentives should be given to industries when they switch over to pollution-free processes.

Dr K.C. Narasimham, CECRI, mentioned that CECRI had earlier organized at Karaikudi a brainstorming session where many issues were discussed in depth. He advocated the use of sodium chlorate for bleaching in view of the fact that chlorate production is greater than its demand.

Dr V. Krishnan, CECRI, pointed out that electrochemically modified electrodes and electrochemical modification of biomass have great potential.

Dr K. Balakrishnan, CECRI, Karaikudi, suggested: (a) Formation of a consortium for funding electrochemical research, (b) Taking up of inter-institutional collaborative projects and (c) Holding of an advanced summer course in electrochemical science and en-

gineering.

Prof. K.I. Vasu, while summing up the session, stated that electrochemistry is slowly emerging as a separate discipline. He called for greater encouragement/incentive for retrofitting of membrane cell technology. He desired a total ban on import of TSIA/DSA since the country has indigenous technologies. Similarly, there is no need to import total membrane cell technology including cells/components, etc. Import of membranes alone can be made duty free, he added.

### Valedictory Function

The valedictory function was addressed by Dr K. Balakrishnan, Vice-President, SAEST; Prof B. Nag, Director, IIT, Bombay; Prof. K.S.V. Santhanam and Prof. Vasu.

Prof. Vasu in his presidential remarks, stressed on the need for evolving energy saving technologies. He also said that the principles of scaling up should be better understood by computer simulation and modelling.

Dr S.N. Malhotra, Secretary, SAEST Bombay Chapter, proposed a vote of thanks.

### Indo-USSR Collaborative Project

#### Trans Indian Ocean Geotraverse Studies

Under the Indo-USSR collaborative project, 'Trans Indian Ocean Geotraverse Studies', marine geophysical and geological investigations covering 600-800 km wide area between the Mascarene Plateau and northwest Australian continental margin were carried out jointly by scientists from the National Institute of Oceanography, Goa, India and the Southern Production Association for Marine Geological Operations, Gelendzhik, USSR, during 1988-90, on board Soviet research vessels.

The various major structural and tectonic units covered include: the Indian Ocean sediment covered basins (Central Indian Ocean, Wharton, Gascoyne and Argo basins), aseismic ridges (Mascarene Ridge and Ninetyeast Ridge), Central Indian Ocean Ridge, and the northwestern part of the Exmouth Plateau near Australian continental margin. The data have been studied jointly by the Indian and Soviet scientists at NIO and Gelendzhik.

Bathymetric, geomorphologic, total magnetic intensity and gravity

anomaly, isopachs of sediments and structure and tectonic maps of the areas have been prepared. The studies reveal the nature, age and structure of the basement and sediments and mineral potential of the units.

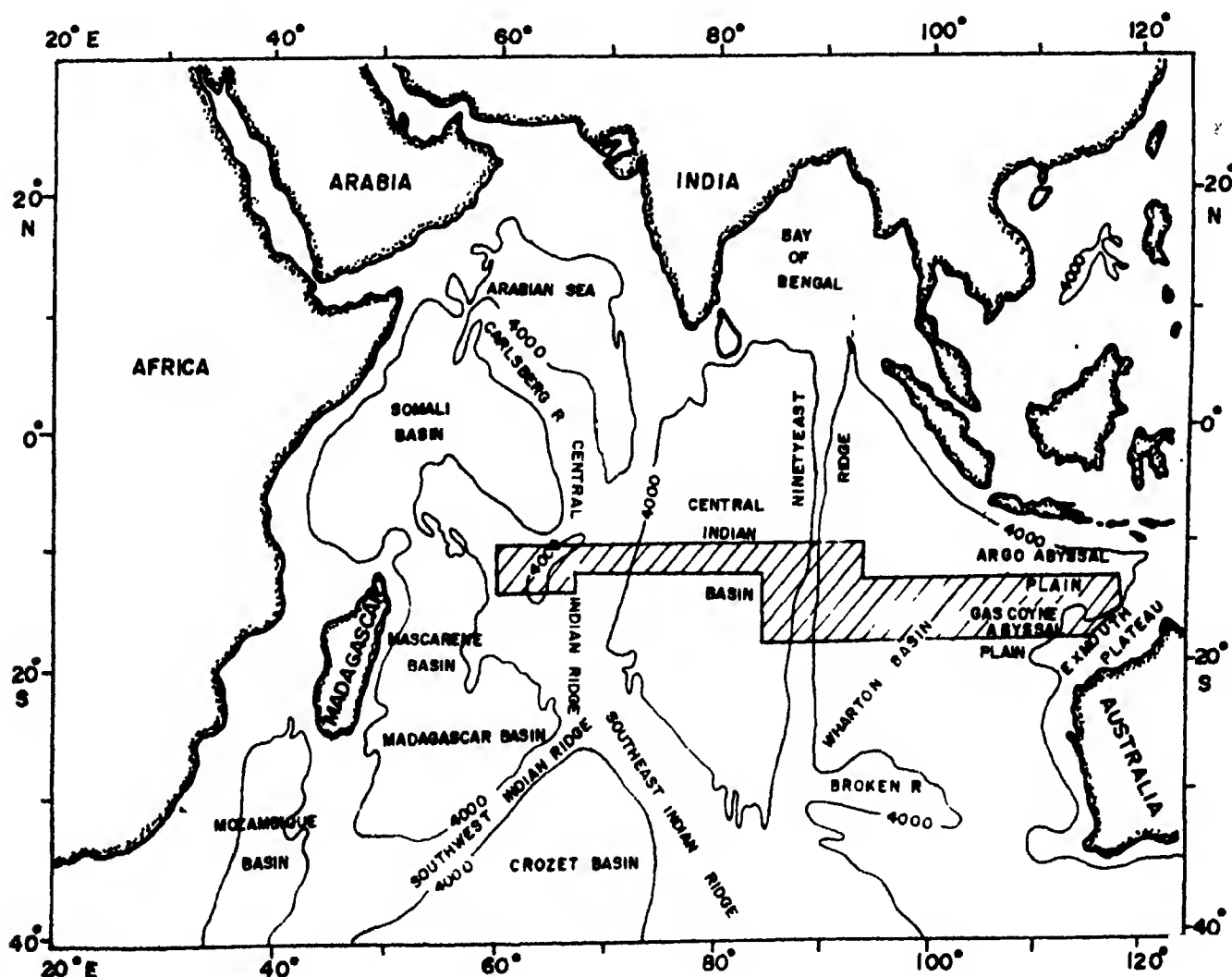
A major transform fault named as Zhivago transform, offsetting the Central Indian Ridge, and various other transform faults have been identified for the first time. The transform fault forms a major structural boundary for varied morphological and structural units of the ridge system, which are different in its north and south regions.

The Mascarene Plateau consisting of relict continental crust is overlain by the Mesozoic-Early Paleocene volcanics and sediments, 2-4 km thick and Early Cenozoic, about 2 km thick carbonate sediments. The oldest, Mesozoic (magnetic chrons M11-M14, 135-141 Ma age) oceanic crust of the Argo Basin is overlain by 0.8-1 km thick (maximum) sediments of early Cretaceous-Cenozoic period. Linear magnetic anomaly, M10 (130 Ma in age) at the western margin of the Exmouth Plateau, an Abandoned Ridge Axis (about 95 Ma in age) trending northeast in the central part of the Wharton Basin, and widespread

compression and upthrust acoustic basement blocks and overlying sediments in the Central Indian Ocean Basin and adjacent to the Ninety degree east ridge were identified. The continental crust of the Exmouth Plateau and Joey Rise is overlain by Paleozoic, Jurassic, Middle Cretaceous (about 3-6 km thick) and Cenozoic (about 2 km thick) sediments.

Ferro-manganese crust of 2 cm thickness, occurs on some of the isometric blocks close to the transform faults.

The thick carbonate sediment covered basins are the promising hydrocarbon prospect areas of the deep seas. □



Map shows study area (hatched), basins, ridges, and plateaus (selected) in Indian Ocean

## NBRI celebrates Its Annual Day

The National Botanical Research Institute (NBRI), Lucknow, celebrated its annual day on 25 October 1990. Prof. C.V. Subramanian, former Director, Centre of Advanced Studies in Botany, Madras University, and a former Jawaharlal Nehru Fellow, presided over the function as Chief Guest.

Welcoming the distinguished guests, Prof. P.V. Sane, Director, NBRI, presented a brief resume of the progress report of his institute and the R&D work carried out in the past one year. Dr Sane reported that among the ornamental plants, two new chrysanthemum varieties, namely 'Haldi Ghati' and 'Maghi' and an outstanding gladiolus hybrid 'Neelofar', were evolved, named and released; a new white bracted cultivar of *Bougainvillea*, 'Hawaii Beauty', having grey green and pale-yellow variegated leaves, was also evolved. A mutant of double bracted *Bougainvillea* cultivar, 'Los banos Beauty', having variegated leaves, similar to *B. × buttiana* 'Scarlet Queen Variegated' was established in culture and multiplied by axillary bud proliferation.

In multilocal trials, opium variety 'NBRI-3' continued to be the best performer for the region. Several mutants of *Nostoc muscorum*, resistant to ammonium analogues, ethylenediamine and methylamine, were isolated and characterized with respect to ammonium transport and properties of glutamine synthetase enzyme. A procedure was devised to isolate chloroplast DNA in poplars. The approximate molecular weight of poplar chloroplast DNA was characterized to be around 140 Kbp. Virazole (ribavirin) and certain dyestuffs, like acridine orange and ethidium bromide, were found effective for virus elimination and



Prof P.V. Sane presenting a resume of the R&D progress of NBRI during the past one year

production of virus-free plantlets *in vitro* in *Solanum melongena*. An aquatic plant, *Ceratophyllum demersum*, was found to be a potential candidate for abatement of Cr pollution as it accumulates high concentration of Cr (to the extent of 268 µg/g dry wt) and can withstand Cr pollution up to 0.1 ppm, which is higher than the highest recommended limit of 0.05 ppm. Somatic embryos, i.e. protocorms of *Vanda hybrid* were encapsulated to form synthetic seeds which, after being stored in a refrigerator for more than 2 months, germinated cent per cent *in vitro* in nutrient agar. The application of urea-rock phosphate and urea-gypsum at 150 kgN/ha and neem cake at 100 kg/ha gave optimal (10.04 tonnes/ha) yield of acceptable quality leaves in betel-vine cv. 'Desawari'.

The NBRI scientists investigated 32 research projects during the year and published 74 research papers in national and international journals and presented 66 others at various symposia, seminars and conferences. Twenty-three popular science/semi-technical articles were also published.

On this occasion, a set of three new publications of the institute,

namely *Leguminosae—Important Source of Gums and Resins*, *Enumeration of Legumes in India*, and NBRI annual report for 1988-89, were released by the Chief Guest.

Prof. C.V. Subramanian, in his address eulogized the R&D work being carried out at the institute. The function ended with a vote of thanks proposed by Dr B.P. Singh, Scientist, NBRI.

The institute also organized a 'Hindi Divas' and an exhibition of scientific literature, published in Hindi, which were largely attended.

Dr N.K. Notani, INSA Senior Scientist of the Bhabha Atomic Research Centre, Bombay, could not be present on this occasion to deliver the Xth Silver Jubilee Lecture on 'Genetic Transformation of Plants'; the lecture will be delivered at some other appropriate time. □

## Portable Optical Methanometer

The Central Scientific Instruments Organisation, Chandigarh and the Central Mining Research Station, Dhanbad, have jointly designed and developed a portable optical

methanometer for quick on-the-spot measurement of methane percentage (range 0.10% in steps of 0.02%) in coal mines and other industries.

The instrument is based on the principle of difference of refractive indices of methane-air mixture and dry air, employing the phenomena of interference of light. The interference fringes consisting of two black lines are produced as in Jamin's parallel plate interferometer and these can be viewed through an eye-piece on a well illuminated scale. Only one dry cell of 1.5V is used in the instrument to operate the two bulbs through microswitches.

The optical system comprises a lamp housing, optically plane parallel beam-splitting glass plate, lenses and slit, prism, zero adjusting prism, objective lens, microscale and the eye-piece. The gas flow system consists of reagent tube, gas chambers (gas cells) and anti-diffusion coiled tube and an aspirator bulb at the outlet; the

eye-piece, inlet and outlet with the aspirator bulb projecting outside the leather case of the instrument. Aspiration of rubber bulb removes previous sample and draws the new gas sample from the surrounding atmosphere for test.

When the methane-air mixture is introduced in the gas chamber by operating the rubber aspirator, fringe patterns are shifted. The shift in black lines is due to the path difference introduced between the two interfering beams produced, and is directly proportional to the methane percentage present in the methane-air mixture. This shift can be read on the calibrated scale. The readings are independent of the voltage of the battery used and can be retained for sometime in the instrument for rechecking and records.

The following are the important features of the instrument: Absolutely safe in explosive atmosphere; Precise and consistently accurate measurement even after long use; Percentage is quickly determined by viewing well illuminated scale; Requires only a few seconds to complete a measurement; Requires no special skill or training to operate; Measurement is independent of the varying voltage of the battery used; Can be used as standard instrument to calibrate other methanometers; Reading can be retained for some time to record; No combustion of gas by hot wire; Maintenance cost is practically negligible, and Completely indigenous, handy, compact and durable.

The instrument has the approval of the Directorate General of Mines Safety, Dhanbad, for use in underground coal mines.

The instrument can be purchased from: The Director, Central Mining Research Station, Barwa Road, Dhanbad 826001.

## PROGRESS REPORTS

### CGCRI Annual Report: 1988-89

The Central Glass & Ceramic Research Institute (CGCRI), Calcutta, pursued during 1988-89, R & D projects under the following four interdisciplinary thrust areas: (1) Optical Materials, (2) Engineering Ceramics, (3) Electronic Ceramics and (4) Lowcost/Alternative Building Materials. Priority was accorded to technology utilization activities. Thirteen processes were released to a total of twenty-one parties for commercial exploitation; five projects/sub-projects were completed; four processes were referred to NRDC for commercial exploitation and two processes involving three parties went into production. Patent applications were filed in respect of four processes. A sum of Rs 11.238 million was received by way of actual receipts and external cash flow through sponsored projects and other sources of income.

The institute, in collaboration with CMRS and CSIO, successfully installed an optical fibre communication system using 225 m of Duplex optical fibre cable for surface to underground audio-transmission link (telephone) in Malkera Colliery (TISCO), situated about 30 km away from Dhanbad. The standard low-loss optic fibre (multimode graded index variety having 50  $\mu\text{m}$  core/125  $\mu\text{m}$  clad) was indigenously developed at CGCRI for the first time from precursor glass preform, the technology of production for which was also developed earlier at CGCRI. The fibres were coated with acrylate resin and then jacketed with jelly filling. The jacketed fibres were cabled by the Hindusthan Cables Ltd. Because of the immunity of the waveguide to electromagnetic interference, the optical system does not suffer from the noise, unlike the conventional



Portable methanometer designed and developed by CSIO, Chandigarh and CMRS, Dhanbad

metal conductor cable system.

High performance refractories were developed utilizing beach sand sillimanite, a byproduct of mineral processing by Indian Rare Earths Ltd. The process was patented and assigned to two firms. One firm has already commercialized the process and has supplied 300 tonnes of high alumina bricks to Visakhapatnam Steel Plant. The other firm was expected to be in production soon. The properties of the bricks are superior to IS specifications and the cost of production is lower than the price of the imported comparable product.

Low-moisture castables were developed and the patented process was assigned to seven parties. Three of them have already gone into production and supplied a few hundred tonnes of the product to the Bhilai Steel Plant, and other industries. The achievement is of special significance in view of the fact that two leading refractory producers had imported foreign technology for making such products.

High density synthetic mullite and mullite corundum high alumina aggregates were developed and released to two parties. The capital investment required is low and equipment is available indigenously. Energy consumption is less and the cost of production and quality are internationally competitive.

A model Ceramic Centre for Rural Development (CCRD) was set up in Bankura, a backward district of West Bengal, in collaboration with the state government under a programme sponsored by the Council for Advancement of People's Action in Rural Technology (CAPART). The Centre, fully equipped with necessary infrastructure including LTM kilns, equipment and machinery and having CGCRI trained local artisans, has been handed over to the

Zilla Parishad and is fully operational. A status report with respect to the rural potters of Taldangra Panchayat Samiti and a know-how document relating to the technology package adopted at CCRD were prepared.

Under the CSIR thrust area project, 'Lowcost/alternative building materials', the institute developed lowcost hollow clay blocks having 4-10 times higher strength than the traditional bricks. These blocks, produced with additions of two major waste materials, viz. cinder ash and fly ash were used in the construction of experimental structures and tested as per IS requirements and found suitable for use as building materials. Composition, firing temperature and schedule, extrusion and drying methods were standardized for optimizing the properties and cost of the hollow clay blocks. It was estimated that lowcost houses may be constructed at a cost of Rs 600 to Rs 700 per sq. metre utilizing these materials. The process has been released to NRDC for commercialization. Attempts, were being made to further improve the properties and to modify the composition suitably for incorporating a variety of other industrial wastes. Development of various alternative building components for roof and wall, fibre reinforced building materials, etc. is envisaged.

The sol-gel route was successfully employed for producing anti-reflective coatings on radiation shielding window (RSW) glass blocks as well as near neutral optical coatings on glass for antiglare applications. Two patent applications were filed in respect of the latter coating which cuts off UV wavelengths substantially and in two-layer design, cuts off  $\gamma$ -wavelengths.

Wavelength selective reflectors for specific applications e.g. in laser devices, interference mirrors,

etc. and anti-reflective coatings (single multilayer) in the visible and near IR regions were also developed. The technology is relatively inexpensive as it does not involve costly equipment. It also affords a far more convenient method for coating of large and heavy glass blocks compared to traditional methods.

Basic studies were carried out on bulk superconducting ceramics prepared in powder form for obtaining an in-depth understanding of the high temperature superconducting mechanism.

In order to gain an insight into the material properties of the superconducting Bi-Sr-Ca-Cu-O system, two sets of samples were prepared, with a nominal composition of  $\text{Bi}_1\text{Sr}_1\text{Ca}_1\text{Cu}_2\text{O}_x$  containing either both the high- $T_c$  (110 K) and low- $T_c$  (80 K) phases or only the low- $T_c$  phase. The X-ray diffraction patterns of both sets of samples were similar and could be indexed by assuming an orthorhombic lattice with  $a = 5.384 \text{ \AA}$ ,  $b = 26.951 \text{ \AA}$  and  $c = 30.608 \text{ \AA}$  (or a pseudotetragonal subshell with  $a=b=5.384 \text{ \AA}$  and  $c = 30.608 \text{ \AA}$ ). The magnetoresistance of the mixed phase samples, which was negligible above 120 K, started to increase below 116 K and exhibited a maximum at about 103 K. In addition, the magnetoresistance showed a sharp increase at temperatures below about 85 K, which was also seen in samples containing the low- $T_c$  phase only. From the experimental data,  $dH_c/dT$  was estimated at 1.98 kOe/K. The thermoelectric power was found to be positive, 19  $\mu\text{V/K}$  at 300 K, indicating conduction through holes. The hole concentration was found to be equal to 0.165 per Cu ion, as calculated from the thermoelectric data. This is in good agreement with the reported value of 0.15, as obtained by titration and thermogravimetric techniques.



In the mixed phase, high  $T_c$  superconductor  $Bi_{1-x}Sr_1Ca_1Cu_2O_x$ , the Doppler broadened position annihilation lineshape parameter was studied as a function of temperature. Anomalies were detected around the two transition temperatures determined by resistance and magnetization measurements which provided indirect support for an electronic mechanism for superconductivity in this system.

The feasibility of fabricating the 1-2-3 superconductor wires and tapes by electrophoretic deposition of the superconductor powders on silver wires and foils was successfully demonstrated. The method is much simpler than the other techniques commonly employed in this respect. The cross-sectional configuration of the wires produced by this technique was different to that obtained by the wire drawing technique. The wires remained flexible even after sintering. Electrical resistivity and susceptibility measurements indicated the  $T_c$  of the fabricated wires to be around 90 K. A patent application was filed in respect of this process.

A specific heat-treatment schedule was identified for improving the current density of bismuth-based superconductors.

High purity ultrafine barium titanate ( $BaTiO_3$ ) powder is a basic raw material for multilayer ceramic capacitor (MLC), PTC thermistor and several other electronic ceramic components. Conventional methods are not suitable for preparation of  $BaTiO_3$  of the required level of purity and fineness. High purity ultrafine  $BaTiO_3$  powder was prepared at CGCRI by oxalate precipitation technique on bench scale (250 g/batch) using titanium tetrachloride and barium chloride as the primary raw materials. The powder thus prepared had surface area in the range of  $2.5 \text{ m}^2/\text{g}$  and narrow particle size distribution between 0.25

and 0.50  $\mu\text{m}$ . Chemical analysis showed  $SiO_2$  -0.04% and  $Al_2O_3$  -0.10%. Process parameters were optimized for obtaining a maximum yield of 95%. Efforts were being made for upscaling the process.

Bismuth oxide was successfully used in the paste to bring down the use of ruthenium dioxide by 50%. The electrical characteristics were improved and refiring effect was minimized.

The paste compositions were standardized for resistors with resistivity of 1 kohm/square with tolerable temperature coefficient of resistivity.

The pilot plant for optical glass is a national facility available at the institute. It is the only one of its kind in the country for developing, upscaling and producing newer types of optical glasses in addition to production of some special types to meet the needs of Defence, Space and of the optical instrument industry. During the year, optical glass valued at about Rs 1.6 million was sold to various organizations.

During the year, forty-five papers were published; forty-four papers/reports were communicated/accepted or were in press for publication and forty-two papers were presented at seminars/symposia/conferences.

### **Motion and Wave Attenuation Characteristics of a Tethered Float System**

Shri P Vethamony while working at the National Institute of Oceanography(NIO), Goa, investigated the Motion and Wave Attenuation Characteristics of a Tethered Float System. The main objectives of the study were: (1) to evaluate float displacement for various wave heights, wave periods, water depths, depths of submergence and float sizes, (2) to estimate the wave attenuation performance of

the system for various combinations of depth, wave and structural parameters and (3) to predict float array size (number of rows of floats) required for the desired level of wave attenuation. A physical model of the tethered float system was developed and experiments were conducted in the wave flume at IIT, Bombay. Wave attenuation of the order of 70-80% was obtained. The system, when placed in proper position, is expected to attenuate a considerable portion of the wave energy and control a major portion of the sediment from entering into the inlet. Further, the performance of the system was studied theoretically using potential flow theory. Equation of motion in linear form for one degree of freedom (surge) was developed to derive float displacement. As the drag produced during the rapid oscillation of the float is the major contributor for wave energy attenuation, linearized drag force was empirically added with the hydrodynamic damping force in the equation of motion.

The natural and resonant periods of the tethered float were computed from the hydrodynamic coefficients. The results were found to be well within the limits of wave periods considered. The system behaved just like an inverted simple pendulum. As float velocity was found to be far greater than the fluid particle velocity, relative velocity instead of particle velocity had to be considered for drag force estimation for floating bodies. The results showed that if the float size is large compared to wave length, float velocity can approach the fluid particle velocity and in such cases drag force may be ignored, which would then become a diffraction problem. A relationship was established between wave force and damping coefficient. The float displacement was found to increase with increase in wave period and wave height and decrease with

increase in float size and depth of submergence. The theoretical model showed that float array size increases with increase in float size and depth of submergence, and decreases with increase in wave period. No variation was noticed in float array size with respect to water depth. Depth of submergence is an important parameter to be considered in site locations with larger tidal variations. Theoretical and experimental results agreed with each other closely.

Based on these results, applying laws of similarity, a field model tethered float breakwater was designed for Tamil Nadu Coast to inhibit the growth of sand bars at the mouths of tidal inlets. Tethered float system can also be used (1) as a temporary protection to coastal as well as offshore activities while construction works, drilling works or salvage operations are in progress and (2) to control coastal erosion. As the performance of the system is independent of water depth it can be used for deep water application as well.

Shri Vethamony worked under the guidance of Dr J.S. Sastry, Deputy Director, NIO, Goa and Dr S. Narasimhan, formerly Professor at the Department of Civil Engineering, IIT, Bombay, and was awarded Ph.D. degree by IIT, Bombay for his thesis based on these studies. □

## TRAINING COURSES

### Advanced Course on Analysis and Design of Transmission Line Towers

An advanced course on 'Analysis and Design of Transmission Line Towers' was conducted during 10-14 September 1990, at the Structural Engineering Research Centre (SERC), Madras. The course was attended by 35 participants in managerial/senior engineer cadres from government, public and

private sector organizations including state electricity boards, NTPC and Tata consulting engineers. The aim of the course was to present recent trends in analysis, design, and testing in transmission line towers, with special emphasis on the software packages such as INTOWER, TANDS and KASTLE (expert system) developed at SERC. Also, the participants were taken to the Tower Testing and Research Station, Tiruculam and were shown a prototype test on a 400 kV tower. The success of the course can be seen from 26 different requests received for the various software packages demonstrated during the course.

## ANNOUNCEMENTS

Special issue of  
Indian Journal of Fibre &  
Textile Research

### Recent Advances in Man-Made Fibres

The March 1991 Issue of the Indian Journal of Fibre & Textile Research is being brought out as a special issue on 'Recent Advances in Man-Made Fibres'.

Guest edited by Prof. V.B. Gupta of IIT-Delhi, the special issue will contain invited papers from internationally known experts. Among the authors are Prof. J.W.S. Hearle, Dr R. Hulsman, Dr H.M. Heuvel, Dr T. Manabe, Dr A.S. Abhiraman, Dr Satish Kumar, Prof. V.B. Gupta, Dr K.V. Darye, Prof. A.K. Sengupta, Prof. Pushpa Bajaj, Prof. N.V. Bhat, Dr B.N. Bandyopadhyay, Prof. A.K. Mukherjee, Prof. V.K. Kothari and Prof. B.L. Deopura.

The topics covered include: Unsolved problems in the science of nylon & polyester fibres; Advances in high performance and other man-made fibres; Fibres from

### Dr A.P. Mitra awarded INSA C.V. Raman Medal for 1991

Dr A.P. Mitra, FRS, Director General, CSIR, has been awarded the Indian National Science Academy's C.V. Raman Medal for 1991.

### Dr B.K. Bachhawat awarded INSA Shanti Swarup Bhatnagar Medal

Dr B.K. Bachhawat, former Director of Indian Institute of Chemical Biology, Calcutta, and at present Head of the Department of Biochemistry, University of Delhi (South Campus), has been awarded the INSA Shanti Swarup Bhatnagar Medal for 1991.

polymer blends; Crystals: their nature & influence on fibre properties; Ceramic fibre precursors; Science & technology of man-made fibres: the Indian R & D scenario; Utilization of polyester waste; Recycling processes and products in nylon-6 fibre industry; Melt flow behaviour of poly(ethylene terephthalate); High-speed spinning of PET yarns; Nylon-6 tyre yarns; and Air-jet texturing. The contents of the special issue (price Rs 60, £16, \$30) are bound to be of immense use to the researchers, technologists, managers and industrialists and would serve as a valuable reference.

Orders accompanied by bank drafts/cheques drawn in favour of Publications & Information Directorate, New Delhi, may be sent to the Senior Sales & Distribution Officer, PID, Hillside Road, New Delhi 110012.

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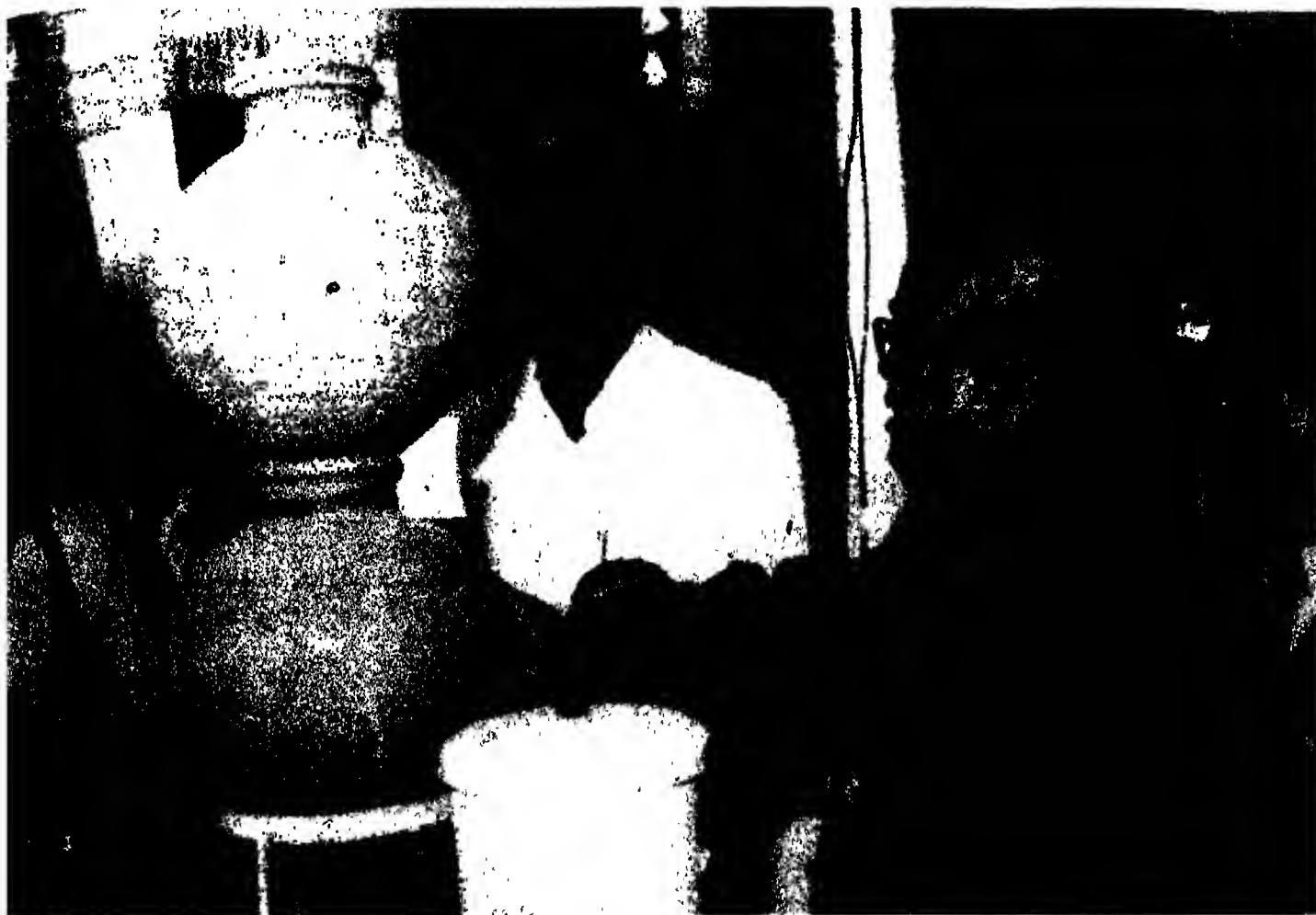
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# CSIR NEWS



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Prime Minister Shri Chandra Shekhar being explained by Dr P.K. Ray, Director, ITRC, the working of 'Amrit Kumbh', a lowcost bacteria filter for obtaining safe drinking water, at the ITRC exhibition '25 Years of Service of ITRC to the Nation' (p26). Also seen in the photograph are: Shri Mulayam Singh Yadav, Chief Minister, U.P.; Dr A.P. Mitra, Director General, CSIR; and Shri Omesh Saigal, Jt. Secretary (Adm.), CSIR

## **Prime Minister dedicates ITRC Silver Jubilee Block to the Nation and releases the Institute's Technologies for Safe Drinking Water**

The Silver Jubilee Function of the Industrial Toxicology Research Centre (ITRC), Lucknow, concluded on 14 December 1990. On this occasion, Shri Chandra Shekhar, Prime Minister of India and President of CSIR, dedicated the Silver Jubilee block of ITRC to the service of the nation and also inaugurated the exhibition: 25 Years of Service of ITRC to the Nation. In the exhibition, ITRC depicted its chronological development. The Prime Minister also released two technologies developed by ITRC, viz. Amrit Kumbh and Bact-O-Kill, for providing safe drinking water in rural and urban areas. Shri Mulayam Singh Yadav, Chief Minister, U.P., presided over the function. During his visit to the exhibition, Shri Chandra Shekhar showed keen interest in the technologies developed by ITRC for the

water quality assessment and the lowcost devices developed for providing safe drinking water.

Shri Chandra Shekhar in his address remarked that the nation is proud of its scientists as they are the hope for India's bright future. Extending his whole-hearted support to the scientists and technologists working for the country, the Prime Minister stressed on the need for greater S&T inputs in tackling the basic problems of the rural areas. He said that our problems are numerous and resources are limited. Therefore, our scientists have to come up with appropriate solutions to the specific problems of the country.

Commending the achievements of ITRC, Shri Chandra Shekhar said that out of the eight lakh villages in the country, only 1.5 lakh have potable water. He hoped

that the water analysis kit, mobile laboratory van and the devices for providing pure drinking water developed by ITRC, would help solve outstanding problems of potable water in the country.

Speaking on the occasion, Shri Mulayam Singh Yadav, said that the country is proud of its scientists who have made outstanding contributions to speed up the process of growth and development. Stating that ITRC has played a remarkable role in this regard, Shri Yadav emphasized the need for developing more of such technologies which would help the rural poor.

Dr A.P. Mitra, FRS, Director General, CSIR, in his address highlighted the activities of the CSIR laboratories. He said that despite the limited resources the scientists and other staff in these institutions are doing their best. However, Dr



Shri Chandra Shekhar addressing the gathering at ITRC

Mitra said, scientific institutions in India are facing the problem of attracting young and highly qualified scientists for which something has to be done. The country has built up requisite infrastructure for science and technology and the take-off stage has been attained. This is high time to put right inputs into the system for full utilization of the infrastructure, the CSIR Director General remarked. He congratulated the ITRC Director and the staff for their achievements.

Earlier, in his welcome address, Prof. P.K. Ray, Director, ITRC, highlighted the contributions made by his laboratory. He said that ITRC had extended support for successful implementation of Safe Drinking Water Programme, Ganga Action Plan and Yamuna and Hoogly Rivers' Biomonitoring Programmes of the Government of India on one hand, and had carried out major tasks during Bhopal disaster, Shriram Mill Gas release, and many others, on the other. He said that ITRC was making concerted efforts to find scientific solutions to outstanding problems of the country, and the institute in the recent past had laid emphasis on rural health programme. A large number of studies had been conducted on the health of rural workers, and on the monitoring of food adulterants in rural areas of the country. Several lowcost technologies developed by ITRC are aimed at solving rural health problems. For example, a portable water analysis kit was developed for safety evaluation of drinking water in rural areas. This technology has since been transferred to five manufacturers for its commercialization in different parts of country. A mobile water analysis laboratory run by solar power and capable of covering hundreds of kilometres in a day, was developed to carry out water safety analysis and to propagate the mass aware-

ness programme. The Department of Rural Development has procured about 20 such laboratories for using in 20 states, for water mission activities. Its technology package has also been transferred for commercialization. He also made a mention of the two new-lowcost technologies released by the Prime Minister, viz. 'Amrit Kumbh' and 'Bact-O-Kill' to provide bacteria-free drinking water to rural and urban population of the country.

Dr Ray further mentioned that extensive work was going on in ITRC to develop a solar-powered community drinking water disinfection system for rural India, and an on-line water disinfection system for urban areas. A solar-powered, mobile cold chain laboratory under the large-scale immunization and vaccination programme was also being developed at ITRC.

In the basic sciences area also, the ITRC Director said, the institute during the past four consecutive years had shown a sharp ascending trend in its research publications, and its impact surpassed that of many others. Many

## **Padma Shri to Dr A.V. Rama Rao, Dr S.K. Joshi and Dr R.A. Mashelkar**

Dr A.V. Rama Rao, Director, Indian Institute of Chemical Technology, Hyderabad; Dr S.K. Joshi, Director, National Physical Laboratory, New Delhi; and Dr R.A. Mashelkar, Director, National Chemical Laboratory, Pune, have been chosen for the Presidential honour Padma Shri, on the occasion of Republic Day 1991.

of ITRC's basic research findings published in more than 1000 publications during the past years had received international acclaim. The research publications of ITRC during the last five years were equal to those published during the previous 20 years, Dr Ray added. □



Shri Chandra Shekhar being explained the working of Bact-O-Kill — a device for obtaining safe drinking water

## Development of Carbon-Carbon Composites at NPL

Carbon-carbon composites are the top ranking ceramic composites for high temperature applications. In non-oxidizing environment, these composites can withstand temperatures of the order of 3000°C, known to be the highest temperature that any material can withstand. Not only this, the strength of these composites does not decrease at such high temperatures. Therefore, these composites are the only materials which can be used at such high temperatures where other materials like metals, and ceramics like alumina, silicon carbide and PSZ Zirconia, fail. The other advantageous characteristics of these composites include: light weight (four times lighter than steel), high specific heat (three to four times that of copper), and low coefficient of thermal expansion (one twentieth of steel).

Ablative properties of these composites are excellent. Not only they exhibit low ablation, the recession and erosion of these composites at high temperatures and high velocities are predictable and

controllable. Because of these characteristics, these composites have been in continuous use in aerospace and military applications such as reentry nose tip, heat shield, rocket nozzle throat and exit cone.

The inherent excellent wear rate of carbon-carbon composites makes them useful for another area of application, namely aircraft brake pads requiring a high coefficient of friction. This material provides smooth friction over the braking period. Their stopping power is four times that of metal brakes, which increases the safety in landing. In weight, they offer a weight saving of about 400 kg over those of steel brakes per pair of brakes.

Also, these composites are of prime importance for the development of reentry vehicles like LCA and hyper-plane.

The technology for making carbon-carbon composites is quite complex and different from that for polymer composites. In fact, it is not a 'technology' but a 'technology package' consisting of many impor-

tant subsystems like carbon fibre preforms, suitable carbon matrix precursor, suitable processing technology and development of ceramic coatings for protection of these composites against possible oxidation at high temperatures. This technology has been developed by a few countries like USA, Japan, France, Germany and UK and is limited to these countries only.

In view of the importance of these composites, the Carbon Fibres and Composites Group\* at the National Physical Laboratory (NPL), New Delhi, took up the task of developing the technology indigenously. The group has carried out extensive systematic basic as well as applied work for each of these subsystems to develop a complete package of indigenous carbon/carbon composites technology.

To conceive carbon/carbon composites for advanced applications, it is imperative to have carbon fibre woven preform with carbon fibres running in desired predetermined directions. The technology of carbon fibre weaving is again a guarded secret. NPL has developed a technology for manual weaving of 3-directionally woven carbon fibre preform.

The other important aspect of carbon-carbon technology is to have a suitable matrix precursor having high carbon yield and suitable flow characteristics in order to impregnate the material right into the smallest pores in the preform. This not only shortens the processing cycle of carbon-carbon composites but also results in composites with high density and superior properties. NPL, through



3-D carbon fibre preform developed at NPL

\*The group comprising Dr O.P. Bahi, Dr L.M. Manocha, Dr G. Bhatia, Dr T.L. Dhami and Dr R.K. Aggarwal have been awarded CSIR Technology Prize (1989) in the field of Material Technology, for developing high density carbon-carbon composites [CSIR News, 40(1990),221].





Carbon-carbon composite nose-tip

extensive R&D efforts, has developed technology for development of two kinds of coal tar pitches, preforming pitch and impregnating pitch. The pitches specially developed for carbon-carbon composites can also be used for other high-performance carbon products.

The quality of carbon-carbon composites depends, to a great extent, on the processing conditions. Thorough studies have been made on the effect of processing conditions, such as impregnating pressure, temperature and coking conditions, on the ultimate properties, specially the density of the composites, because it is the density which decides the ablative behaviour of the material. To make high-density carbon-carbon composites, having density of the order of 1.9g/cc, high pressure impregnation/carbonization (HIP) technique involving pressures of the order of 10,000 bars or so, is used. This is quite complicated and costly; moreover such high pressure autoclaves are not available in India. At NPL, a novel technology of intermediate graphitization has been evolved wherein high density of the order of 1.8-1.9 g/cc has been achieved by processing even at moderate pressure of 30 bars.

These composites were characterized for mechanical and thermal properties both at NPL and at DRDL-Hyderabad and found to be satisfactory. A scaled down nose tip was made with the carbon-carbon composites developed at NPL. This was tested at DRDL-Hyderabad using Lexhaust test and was found satisfactory.

For the use of carbon-carbon composites at temperatures above 500°C in the oxidizing atmosphere, a protective coating has to be applied to them. NPL has developed protective coatings against oxidation of carbon-carbon composites based on borates, phosphates, SiC, etc. The weight loss of carbon-carbon composites in oxidizing atmosphere was reduced from 25% to 3% at 1500°C. □

### Pollution Abatement from Lime Kilns

Lime is an important building material as well as a raw material for many other industries. A major portion of lime is produced in cottage/small scale sector. Limestone is burnt in conventional kilns which are of poor thermal efficiency, and use low grade steam coal

which contains ash and volatiles in the range of 40-55%, causing lot of air pollution. The industry consumes about 1.3 million tonnes of this coal annually. Apart from kilns, other operations such as hydration, milling and packing also add to pollution in the area. Concentration of several lime kilns and other allied units in a small area increases the overall pollution impact of these units.

A survey of one of the production centres (Dehra Dun) was undertaken by the Central Building Research Institute (CBRI), Roorkee. At one location, about 60 units were working round the clock, calcining over 400 tonnes of limestone, hydrating and nulling 80 tonnes of lime per day in a small area of 70 acres. These units produced huge clouds of smoke over the entire area, causing inconvenience to the workers and the inhabitants living around.

Emissions from two vertical shaft kilns, KVIC type and CBRI type, were studied at Dehra Dun and Paonta Sahib, respectively. The various parameters studied are dust, SO<sub>2</sub>, H<sub>2</sub>S, NO<sub>x</sub> and hydrocarbons. The study revealed that while the levels of acidic gases in flue gases were within the emission levels laid down by the Central Pollution Control Board, the levels of dust and hydrocarbons were higher and hence needed to be controlled. The particle size analysis of dust samples showed that 82 to 96% of it was higher than 10μ in size.

Ambient air quality in the vicinity of lime kilns in Respina bed of Dehra Dun was monitored. Seven air quality monitoring stations were set up in the area, and the average ground level concentration of various pollutants was measured.

Based on the studies carried out on some existing lime kilns, suspended particulate and the tarry organic matter were identified

to be the major pollutants from the coal-fired vertical shaft kilns. The average SPM and the hydrocarbon fraction were of the order of 1000 mg/nm<sup>3</sup> and 750 mg/nm<sup>3</sup> respectively. About 90% of the particle size was found to be less than 10  $\mu$ . The quantity of flue gas for the 10 tonnes/day capacity mixed-feed lime kiln varied from 2000 to 2500 mg/nm<sup>3</sup> and the average exhaust gas temperature at the top of the kiln was found to be around 150°C.

### Pollution Abatement System

Keeping in view the above observations a pollution abatement system was evolved incorporating the features of inertial separation and water scrubbing. It consists of a contactor stage followed by centrifugal separator. In the first stage, a water spray is impinged

into the gas stream. Thereafter the effluent stream is passed through a cyclone where more water is sprayed. The deposited dust particles conglomerate along the inner wall of the separator and being heavy tend to settle down. The gases are passed through a packed bed demister for entrainment of water and tarry matter. The gases are then released to the atmosphere by an I.D. fan through a chimney.

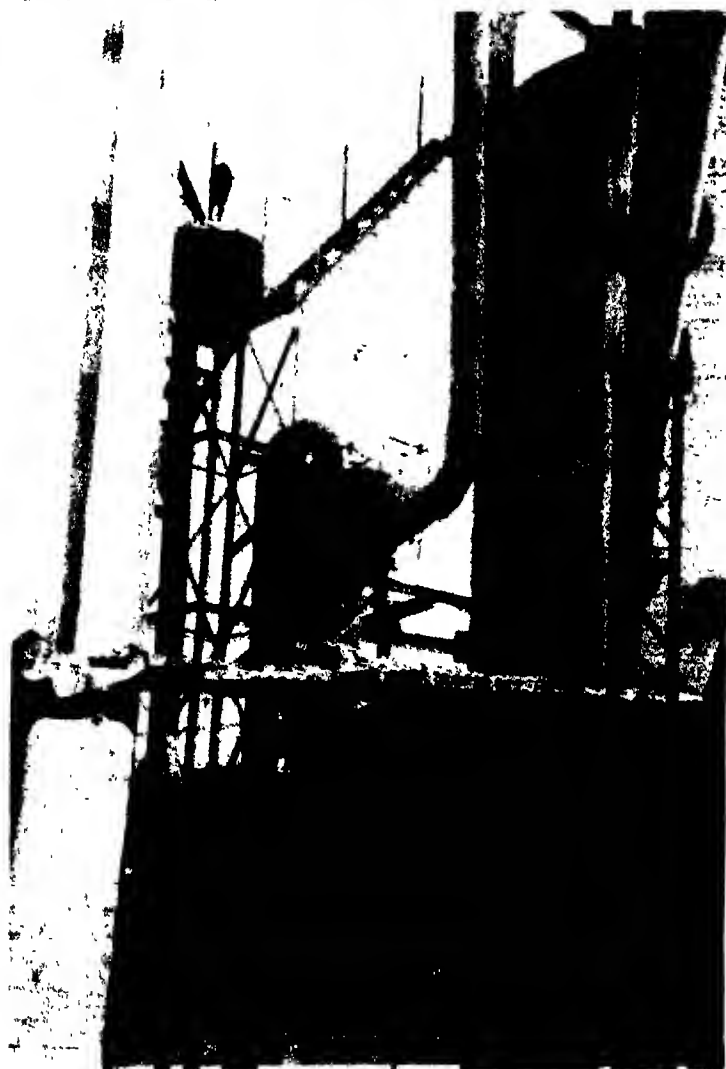
The pollution control system has been fabricated and installed at the lime kiln of M/s Himalaya Chemicals, Paonta Sahib (HP) — a licensee of the CBRI improved design lime kilns. Feed back studies to monitor the performance of the system are in progress. Preliminary experiments have shown encouraging results.

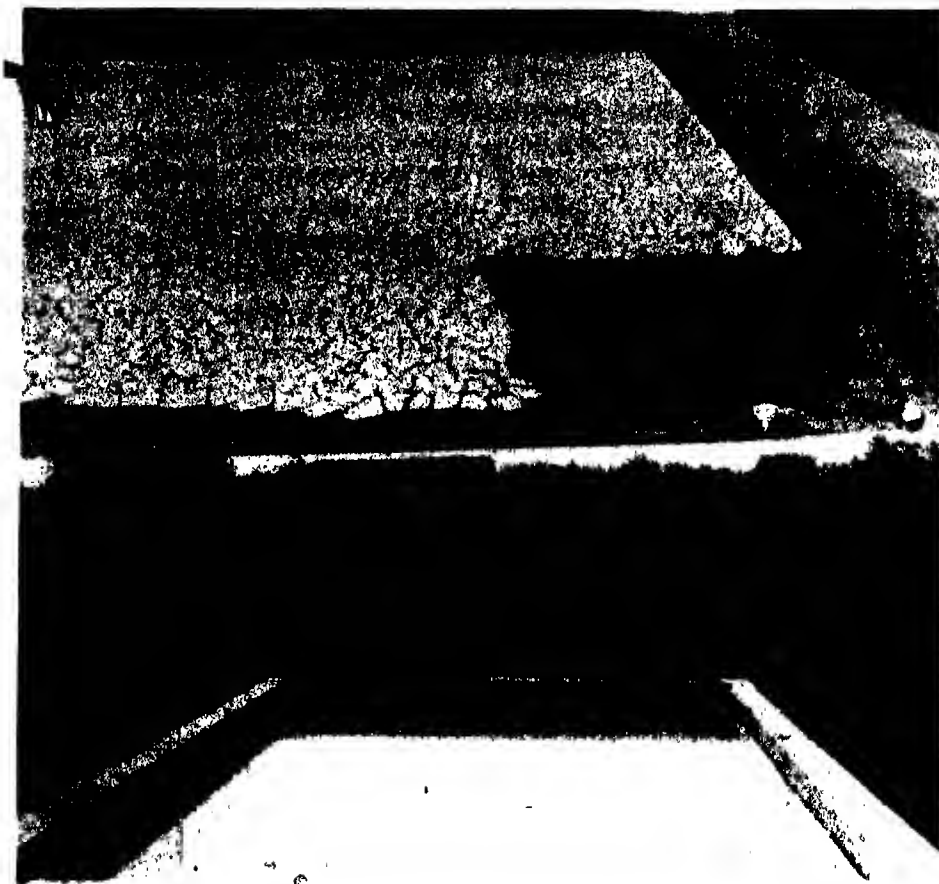
This work is a part of the CSIR Thrust Area Project on Lowcost/Alternative Building Materials and Components — Environmental Considerations, and was carried out in collaboration with the National Environmental Engineering Research Institute, Nagpur. □

### Alternative Heat Insulating Treatment for Roofs

The investigations made at the Central Building Research Institute (CBRI), Roorkee, have shown that in place of heavy lime-concrete and mud-phuska clay tile, and white washing treatment, a light-weight concrete (600-800 kg/m<sup>3</sup>) of cement and a lowcost product like sintered fly ash, cinder, or bloated clay aggregate can be employed in the ratio 1:5 (thickness, 2.5 cm), together with surface treatment with white coloured glazed china tile pieces. Light-weight materials reduce appreciably dead load on roof while other drawbacks are taken care of by china tiles. These tiles do not allow absorption of dust particles, and accumulation of dust could be cleaned by brushing without affecting its glossy surface. During rains, the tile surface gets cleaned automatically. In this way, tile pieces maintain continuous reflective character. The CBRI studies have shown that with properly embedded tile pieces on 10 cm RCC roof, temperature of the roof, ceiling and indoor air could be reduced up to 16, 12.5 and 3°C, respectively. Further studies have shown that application of 0.4 cm thick broken glazed tile pieces on RCC roofs could reduce the ceiling temperature up to 12.5°C. This surface treatment could very well compete with the conventional treatments.

Pollution control device at a lime kiln





Heat insulation treatment of a roof using China tile pieces. roof under treatment (top) and the treated roof

Employment of the tile pieces of  $3\text{cm}^2$  and above demands certain precautions so that the treatment forms an integral part of roof construction. In order to avoid accumulation of water on roofs which causes erosion of mortar at joints, roof should be provided with proper gradient as per Indian Standards and high quality cement: sand (1:3) mortar. The mortar layer of 0.4 cm is laid after mixing in it 10% aquaproof waterproofing solution. Finally, a rock type glossy white roof surface is obtained.

Preliminary trials were carried out on 25 roof panels and also on a roof ( $4 \times 3\text{m}^3$ ) of a room. Besides this, application of these tiles on  $2.5\text{cm}$  light weight ( $800\text{ kg/m}^2$ ) polymer concrete was carried out successfully on about a  $100\text{ m}^2$  roof surface area of a newly constructed house. Studies on the application of these tile pieces is in

progress at a  $300\text{ m}^2$  roof surface area of another building in Roorkee.

The treatment is quite cheap; the total cost, including that of tile pieces, cement, sand, and labour works out to Rs  $50/\text{m}^2$ . □

### Stowing without Sand Pump at Surakachar Colliery of SECL

The Stowing Research Team of the Central Mining Research Station (CMRS), Dhanbad, took up a study on stowing without booster pumps at Surakachar Colliery of SECL. In this colliery, the hydraulic stowing system had been designed by Russian experts in early sixties for working a moderately thick seam by longwall method of mining in conjunction with stowing. Since the workings are shallow ( $<120\text{m}$ )

two booster sand pumps of Russian design, each driven by  $160\text{kW}$  motor, were fitted in a  $250\text{ mm}$  diam. range for stowing in eastern side longwall panels. With the advance of the working panels and lengthening of the pipe ranges, the stowing efficiency, even with the booster pumps, had gone down considerably, adversely affecting the rate and cost of production, so much so that, it took nearly four to six shifts to complete one cycle of stowing in the panels at a water to sand ratio going even up to 7:1 during hydraulic stowing. Owing to large water consumption, the underground sumps were always full, causing frequent stoppage of stowing operation and excessive energy cost in pumping back stowing water. Wear and tear of pump impellers was another recurring cost as they had to be changed twice a month.

Based on results of frictional loss data generated during the course of investigations by CMRS stowing research team and the correlation equations developed for flow of Indian river sand, the efficacy of hydraulic stowing without booster sand pumps was assessed. Trials were made after eliminating booster sand pumps. It was possible to stow at a rate of  $250\text{ tonnes/h}$  with a water/sand ratio of 4:1, without the pumps both on the eastern and western side panels.

The mine management was planning to install a bore-hole stowing plant for working remote panels near the boundary on the western side. Based on the CMRS correlation equation developed earlier, it was found possible to carry out stowing in these remote panels using the existing plant under gravity with a combination of  $250\text{ mm}$  diam. main range and  $200\text{ mm}$  diam. HDP pipe at the face. This will cause further saving in capital cost. □

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## **Methane Emission Study at Amlabad Colliery**

The Amlabad colliery of BCCL in Jharia coalfield is one of the most gassy mines in India. A working group comprising officials from DGMS, BCCL, CMPDIL and the Central Mining Research Station (CMRS), Dhanbad, has been looking after the short-term and long term measures including feasibility/necessity of degasification for control of the gas in the mine. At the instance of General Manager, Amlabad Project Area and as part of the work being carried out by the group, CMRS undertook investigations on methane emission in XV seam of the mine.

Qualitative and quantitative assessment of the mine air in the XV seam depillaring district indicated a methane emission rate of  $31.4 \text{ m}^3/\text{tonne}$  of the coal produced. Ventilation system of the mine was found to exhaust  $10.03 \text{ m}^3$  of methane per minute of which  $3.38 \text{ m}^3/\text{min}$ , was the contribution from the depillaring district.

Percentage of methane in the general body air was found to vary from 0.12 to 0.24. Air samples collected from 1.5m deep boreholes showed high percentage of methane ranging from 16.0 to 57.6. A significant rise in methane percentage was found to have taken place with time in most of the boreholes.

Investigation on a planned stoppage of the main mechanical ventilator for 1h revealed appreciable build up of methane to the extent of 1.3% in the working district and a time period of about one and a half hours was required to dilute the build-up of the gas to the earlier original condition.

The investigations revealed that the high rate of relative emission of  $31.4 \text{ m}^3/\text{tonne}$  is due to

present low production of 155 tonnes/day. No significant accumulation of methane was observed anywhere in the working district. However, in the event of any accidental stoppage of the main mechanical ventilator, requisite precautionary measures were recommended to clear off the accumulated gas prior to resumption of work.

## **Finite Element Method for Analysis of Structures**

**Dr G.V. Rao's Bhatnagar Prize-winning Work\***

Aerospace structures are complex in nature and are subjected to complex loading conditions. As such, simple closed form solutions cannot be obtained for these structures and numerical methods have to be resorted to find the solutions. One such most powerful numerical method is the Finite Element Method. Dr Rao has been working in this field for the last 20 years and has made significant contributions both in the element development and application areas. His main field of research has been concerned with the eigenvalue problems connected with free vibrations, static stability and dynamic stability. He has also contributed to the field of stress analysis, through development of new elements. Eventhough his main thrust of research has been on the finite element method, he has also been working on continuum methods for predicting the behaviour of structural elements like beams and columns with emphasis on both geometric and material nonlinearities.

### **Bounds for Eigenvalues**

Initially, Dr Rao worked for developing simple, efficient and accurate numerical methods in conjunction with the finite element

A study on the coal bed reservoir behaviour (e.g. determination of gas emission space, sorption characteristics of the coal and in seam permeability and porosity) has been recommended for planning of length, diameter and inclination of the degasification boreholes for effective control of the gas in the mine. □

method to provide upper and lower bounds for eigenvalues like frequencies, critical loads of structural elements. This formed the main topic of his Ph.D. thesis. In the absence of exact solutions for



many practical problems, these bounds are useful to predict the eigenvalues quite accurately.

### **Inverse Form of Ramberg-Osgood Formula**

Dr Rao proposed in his Ph.D. thesis, an inverse form of Ramberg-

\*Dr G.V. Rao of the Vikram Sarabhai Space Centre, Trivandrum, has been awarded the 1989 Shanti Swarup Bhatnagar Prize in Engineering Sciences (along with Dr S. Banerjee, of the Bhabha Atomic Research Centre, Bombay) [CSIR News, 40(1990), 221 & 41(1991), 14].

Osgood formula for the stress-strain curve which can be effectively used in evaluating the stiffness matrices for the elasto-plastic analysis of structural elements by the finite element method. This formula has been widely used by other researchers in their further study. The formula can be directly and effectively used in the finite element (displacement formulations) method.

### **Development of New Finite Element**

During the initial phase of his work at Vikram Sarabhai Space Centre (VSSC), Trivandrum, Dr Rao developed new finite elements for application in the analysis of rocket structures like motor casings, interstages, etc. To name a few: (a) High precision plate bending and stiffener elements, (b) High precision shell of revolution element and (c) Cylindrical and conical shell finite elements. All these elements have capabilities for performing stress, free vibration and stability analysis.

### **Structural Optimization**

During his stay at the NASA Langley Research Centre, he worked on the optimization (minimum weight design) of heated structures subjected to thermal loading with temperatures and stress constraints. He developed for the first time, the optimality criterion (which was very popular for mechanical loads at that time) for the aforementioned problem. The optimality criterion approach is highly efficient, computer time-wise.

Based on his experience at the NASA Langley Research Centre, he developed new algorithms for the optimization of structures with constraints on displacements, stresses, frequencies, critical loads and temperatures. He developed new concepts like tapered or higher order elements, with new definition

of design variables, in the optimality criterion approach. Also, he extended the method to include the nonlinear structural behaviour.

### **FEAST**

Dr Rao's most important contribution for the structural engineering community in the country is the development of a general purpose program for structural analysis, FEAST (Finite Element Analysis of Structures). He successfully led a team of structural engineers to develop this package which is the first of its kind developed in India. It has been implemented in the computer systems at VSSC-Trivandrum, DRDL-Hyderabad and RDSO- Lucknow. Outside agencies like DCPL have used this package to solve their structural engineering problems. The technology has been transferred to CMC Ltd, for marketing.

### **Nonlinear Analysis**

Dr Rao has developed for the first time a simple, direct finite element formulation for studying the nonlinear vibrations of structural elements. The results obtained in this study have been used by many researchers to validate their formulations developed later.

He has also developed a similar formulation, for the post-buckling analysis of structural elements using the finite element method.

The formulations developed are land-mark finite element formulations and have been cited quite often by many researchers. The vast amount of numerical results produced will be directly useful for structural design engineers.

### **Continuum Formulations**

Dr Rao has developed a general nonlinear formulation for the bending, vibration and stability analysis of beams/columns considering geometric and material nonlinearities with variable

geometric properties along the length. Both conservative and non-conservative loads are considered in the formulation. This formulation finds direct applicability in rocket and missile structures.

### **Nonlinear Analysis of Composite Beams and Plates**

New higher-order finite element and continuum formulations have been developed to study the geometrically nonlinear behaviour of thick unsymmetric laminated beams and plates. Preliminary results indicate that the nonlinear bending stiffness is direction dependent. Solutions are being obtained for bending, free vibration and stability of composite beams and plates, including the effect of geometric nonlinearity. The proposed formulations can be effectively used to predict the structural response accurately where the standard perturbation method fails.

### **Miscellaneous**

In addition, Dr Rao has made a detailed study of secondary effects like shear deformation and rotatory inertia in structural analysis in general and static/dynamic stability in particular.

He has also studied the stability of nonconservative systems using both finite element and continuum formulations including the post critical behaviour.

The vast amount of numerical results produced during these studies are of great value for both researchers and design engineers in the field.

Dr Rao (born 9 Nov. 1944) took his bachelor's degree in Mechanical Engineering (first class with distinction) from the Andhra University, Waltair, in 1966, and Master's and Ph.D. degrees in Aeronautical Engineering from the Indian Institute of Science, Ban-

galore, in 1968 and 1973 respectively.

He was Head of the Finite Element Analysis Division of VSSC, from 1972 to 1978; Head of the Advanced Software Development Section, Aerospace Structures Division, from 1978 to 1986, and has been Head of Structural Design and Analysis Division, since 1986.

Dr Rao was Senior Research Fellow of UGC and CSIR during 1969-70 and 1970-72, respectively.

ly. He received the 'Distinguished Achievement Award' for his contribution (structural analysis) towards the first Indian Satellite — Aryabhata. He was NRC-NASA Langley Resident Research Associate, NASA Langley Research Centre, Hampton, USA during April 1976 - April 1977. A Member of the Aeronautical Society of India and Founder Life Member of the Indian Society for Advancement of Material and Process Engineering. Dr Rao has over 225 technical publications to his credit. □

## Chromosome Organization and Replication in *Drosophila*

Prof. S.C. Lakhotia's Bhatnagar Prize-winning Work\*

During the past two decades, the heat shock response has been a major paradigm for analyzing gene expression and its regulation. The expression of heat shock genes is dramatically turned on under conditions of cellular stress and their transcripts are rapidly translated to produce the heat shock proteins. For the past 20 years, Prof. Lakhotia has been studying a different kind of heat shock gene of *Drosophila melanogaster*, whose transcripts have unusual properties and which are not translated. A series of studies showed that this heat shock locus is also singularly and specifically inducible in polytene nuclei by brief *in vitro* treatments with benzamide, colchicine, heat shocked glands' homogenate, etc. and that a functional homologue of this locus was present in every species of *Drosophila* that was examined. His lab provided the first evidence that transcripts of this locus may not be translated. A series of other studies

revealed many more intriguing properties related to specific induction or non-induction of the 93D



locus. Different inducers of 93D were found to elicit different patterns of transcript populations with dramatically different turnover rates. All these studies have indicated that the 93D locus is a novel type of gene of vital importance to the organisms, which functions through the structure of its transcripts rather than protein-coding properties.

Prof. Lakhotia has also made significant contributions to several other aspects of chromosome organization and gene expression in *Drosophila* and other diptera, particularly relating to the mechanism of dosage compensation, replica-

tive organization of polytene and non-polytene chromosomes and the expression, evolution and biological role of heat shock genes.

His doctoral work provided strong evidence for the then newly proposed hyperactive male-X model of dosage compensation in *Drosophila* and demonstrated that the hyperactivity of the male X was cell autonomous.

Earlier studies by him and his colleagues provided extensive data on the effects of sex, different rearing conditions, chromosome rearrangements, tissue types, etc. on the temporal order of replication of specific replicating units in polytene chromosomes of *Drosophila*. His laboratory also studied in detail the chromosome replication and cell cycle patterns in mitotically dividing cells in larval brain. Extensive studies on the organization of active replicons in polytene chromosomes of larval salivary glands by DNA fibre autoradiography revealed for the first time the existence of two distinct categories (Type I with longer size and faster rate of fork migration and Type II with smaller replicons and slower rates of fork migration) of active replicons in the same cell. Two distinct types of active replicons were found in larval brain and imaginal disk cells also. An important inference from these studies was that replicon clusters were absent in *Drosophila* chromosomes.

He elucidated structure of the  $\alpha$ - and  $\beta$ -heterochromatin in polytene nuclei of *Drosophila* by electron microscopy and EM autoradiography and showed for the first time that the  $\beta$ -heterochromatin was very active in transcription. A variety of techniques (EM autoradiography; BrdU-labelling and fluorescence microscopy, cytofluorometry, etc.), were used to demonstrate that in several different endoreplicating cell types in *Drosophila*, the

\*Prof. S.C. Lakhotia of Banaras Hindu University, Varanasi has been awarded the 1989 Shanti Swarup Bhatnagar Prize in Biological Sciences (along with Dr Manju Ray of the Jadavpur University, Calcutta) [CSIR News, 40 (1990), 221 & 41 (1991), 14].



heterochromatic regions often remain under-replicated.

Using fluorescence microscopy in conjunction with base-specific fluorochromes, the nature of DNA sequences associated with heterochromatin in related species of *Drosophila* was compared. Restriction enzyme digestion of cytological preparations *in situ* and of genomic DNA in gels coupled with southern and *in situ* hybridization with satellite DNA revealed that all the blocks of heterochromatin in *D. nasuta* are remarkably homogeneous in their sequence composition.

With a view to analyzing the possible biological roles of the heat shock response, a series of studies were initiated in his laboratory to examine the effects of developmental conditions and cell specializations on the heat shock response. The 23kd heat shock polypeptide (hsp) was inducible neither by heat shock nor by ecdysone in *D. melanogaster* larvae grown at 10°C. In *Chironomus* and *Anopheles*, both adapted to tropical climates, the inducibility of heat shock genes and hsp was dependent upon the environmental conditions. Thus the heat shock response has homeostatic role also.

A very significant recent observation was that the malpighian tubules of *D. melanogaster* larvae made an entirely different set of hsps with no trace of the usual hsps. This observation opens a new dimension to studies on the heat shock response since so far the heat shock response was believed to be a highly conserved and ubiquitous response.

Prof. Lakhotia (born 4 Oct. 1945) did his B.Sc. (Zoology Hons.) (1964), M.Sc. (Zoology) (1966) and Ph.D. (1970) from the Calcutta University, securing first rank in B.Sc. and M.Sc. examinations. He worked in Zoology Departments of various universities: as Post-Doc-

toral Fellow at the Delhi University (Aug. 1970-May 1971), as Lecturer at the Burdwan University (June 1971-May 1972) and at the Gujarat University (June 1972-Sept. 1976), and as Reader at the Banaras Hindu University (BHU) (Sept. 1976-June 1985). In June 1985, he became Professor in the Department of Zoology of BHU. He has visited and delivered lectures at several institutions/universities in USA, Canada, UK, Norway, Holland, Germany, France and China.

He is recipient of various research awards: Overseas Scholarship of the Royal Commission for the Exhibition of 1851, London (1972-73); Young Scientist Medal of INSA (1975); Career Award of UGC (1979); Fulbright Senior Visitor Scholarship (1984-85); and National Lecturership of UGC (1989-90). He has 82 research papers to his credit and has supervised 10 students in their Ph.D. work; six students are currently working under his guidance. □

### Ameliorating Effects of Dietary Protein and Vitamin A on Toxicity of HCH to Albino Rats

Many organochlorine pesticide residues found in food are capable of producing secondary deficiencies of vitamin A in animals, besides other deleterious effects. The activities of enzymes like Mixed Function Oxygenases (MFO) responsible for the metabolism and elimination of xenobiotics are significantly lowered as a result of vitamin A and protein deficiencies.

Shri Pius Joseph while working at the Central Food and Technological Research Institute (CFTRI), Mysore, studied the consequences of such interactions on the toxicity of hexachlorocyclohexane (HCH), an organochlorine pesticide and the

protective role of vitamin A at 2000 and 10<sup>5</sup> IU/kg diet (not hypervitaminotic) in albino rats. Besides this, the influence of protein (7% and 17%) in the diet, on the chronic toxicity of HCH in rats was also assessed.

Shri Joseph carried out a comprehensive literature survey on HCH, its mammalian toxicity, biochemical, histological and histochemical alterations, distribution and accumulation of isomers of HCH and the role of micro and macro nutrients on xenobiotic toxicity.

The studies made by the researcher showed that the vitamin A deficiency could be induced in weaning rats at ninth week. While 2000 IU of vitamin A/kg diet was adequate when fed to rats for 12 weeks, the level of 10<sup>5</sup> IU/kg diet was not hypervitaminotic and the hepatic vitamin A stores were related to the dietary vitamin A levels. The acute oral LD<sub>50</sub> and LD<sub>90</sub> values of HCH varied significantly in three diet groups, being lower (1338 mg/kg b.wt. LD<sub>50</sub>) in vitamin A deficient rats with higher intensity and prolonged duration of symptoms. The LD<sub>50</sub> values were higher (2869 mg/kg b.wt.) in rats supplemented with vitamin A in excess. Significant alterations and sensitivity of serum transaminases in vitamin A deficient HCH intubated rats suggested that these key enzymes could be better diagnostic indicators of acute exposure to HCH.

Short-term dietary toxicity studies indicated that rats supplemented with vitamin A at both levels tolerated 1000 ppm of HCH for 7 weeks, compared to their counterparts without vitamin A supplementation. HCH depleted vitamin A stores with significant alterations in liver and serum enzymes besides histological changes.

Shri Joseph also observed that the dietary HCH at 1000 ppm fed

for 7 weeks to male rats significantly affected the sperm counts, testicular enzymes and induced atrophy, increased susceptibility of accessory reproductive organs and inhibition of steroidogenesis. These changes could be reversed after the withdrawal of HCH and the process of recovery was slower in vitamin A deficient rats compared to rats with vitamin A supplementation.

An interesting correlation was observed between the phenobarbital sleeping time and hepatic xenobiotic metabolizing enzymes in different diet groups. Reduced activity of these enzymes in vitamin A deficient rats indicated the lower rate of metabolism and consequently, enhanced toxicity of HCH while vitamin A supplementation counteracted the effects of HCH and ameliorated the toxicity by way of synthesizing more MFO, which is a biochemical (physiological) adaptation.

Shri Joseph demonstrated the protective action of dietary protein at normal (17%) level compared to lower (7%) against the toxicity of HCH at 20 ppm and 100 ppm for 52 weeks. No observable significant change was discernible till six months. But at the end of 12 months, rats fed with low protein diets were susceptible to HCH at 100 ppm, as judged by histological, histochemical and biochemical parameters. The tissue distribution of isomers of HCH was: in adipose>kidney>brain>liver, respectively.

Shri Joseph carried out the above work under the guidance of Dr(Smt.) M.K. Krishnakumari, Infestation Control and Protectants Discipline, CFTRI, and was awarded Ph.D. degree by the Mysore University for his thesis based on these studies.

## NEW PUBLICATIONS

### Environmental Biology of Water Hyacinth

The title monograph [author: Dr (Smt.) Kaiser Jamil, Scientist, Biology Section, Indian Institute of Chemical Technology, Hyderabad] provides state-of-art on the plant/weed *Eichhornia crassipes* (Mart) Solms, popularly known as water hyacinth. It presents results of the investigation on biology, pollution and control strategies. The monograph was released by Dr A.P. Mitra, FRS, Director General, CSIR, on 17 September 1990 at a small function held in New Delhi. The publication of this monograph was sponsored by the Commonwealth Science Council, London, and it has been published by the Avichal Science Foundation, Vallabh Vidyanagar, Gujarat.

### Memoirs 1989—CECRI, Karaikudi

The Central Electrochemical Research Institute (CECRI), Karaikudi, has brought out the title publication containing abstracts of research papers published by the CECRI scientists in various journals and also the abstracts of papers published in *Bulletin of Electrochemistry*. Copies of CECRI News published during 1989, are also appended.

For copies of the above publication and full text of any research paper whose abstract is given in the publication, please write to: The Director, CECRI, Karaikudi 623006.

### Honours & Awards

#### Dr J. Das wins Ranbaxy Research Award 1989

The Trustees of the Ranbaxy Research Foundation have selected Dr J. Das, Scientist, Indian Institute of Chemical Biology, Calcut-

ta, for an additional Ranbaxy Research Award for 1989 in the field of Medical Sciences to be shared with Dr V.R. Muthukaruppan of the Madurai Kamaraj University.

Dr J. Das gets the award for his outstanding research work on (i) construction of an *Escherichia coli* strain which can excrete the B sub-unit of cholera toxin. This strain is a potential live oral vaccine for cholera; (ii) demonstration of the regulation of toxin production and several metabolic functions in *Vibrio cholerae*; (iii) elucidation of the mechanisms by which *V. cholerae* cells can repair damage in their DNA molecules, which is extremely important in problems of mutagenesis. He has also demonstrated that *V. cholerae* cells cannot be mutated by UV light due to lack of a certain gene complex. He has elaborated the process of infection by choleraphages and demonstrated that the cell surface of *V. cholerae* is unique among all enterobacteria and plays a major role in the excretion of toxin. □

### PATENTS FILED

623/DEL/90: A process for the manufacture of catalytic cathodes for hydrogen evolution reactions. S.K. Rangarajan, K.I. Vasu, S. Krishnamurthy, P. Subbiah, K. Asokan, K. Subramanian, V. Arumugam — Central Electrochemical Research Institute, Karaikudi.

624/DEL/90: A process for the production of a coking agent having low ash and high fluidity useful for blending with substandard coals to make strong coke. M. Chakaraborty and R. Haque — Central Fuel Research Institute, Dhanbad.

869/DEL/90: An improved process for the preparation of monochloroanisole. V. Krishnan, A. Muthukumaran and T. Raju — Central Electrochemical Research Institute, Karaikudi.

# CSIR NEWS



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Different types of pottery liners and parts for improved chulha (left), and ceramic lined portable improved chulha developed by the Khurja Centre of Central Glass & Ceramic Research Institute (p. 39).

## IN THIS ISSUE

International Conference on Management of Data (COMAD-90) ... 38	Sealed-off Mine Reopened by Flushing Liquid Nitrogen ... 42	Solitons and Chaos in Nonlinear Dynamical Systems—Prof. M. Lakshmanan's Bhatnagar Prize-winning work ... 44
CSIR and UGC sign a Memorandum of Understanding ... 39	Design of Supports for Mine Roadways ... 43	CDRI Annual Report: 1989-90 ... 45
Prospectives of Increasing Yield and Quality in Tea ... 41	Process for Preparing Unwrinkled Green Pepper ... 44	Prof. V.S. Rama Das takes over as Director, CSIR Complex, Palampur ... 48
Method for Selection of Coal Mining Machine ... 41	Palm Oil Extraction using Microwaves ... 44	

## International Conference on Management of Data (COMAD-90)

An international conference on management of data (COMAD-90) was organized by the Indian National Scientific Documentation Centre (INSDOC) in New Delhi during 12-14 December 1990. The conference was preceded by a set of tutorials during 10-11 December covering the topics : object-oriented databases, advanced entity relationship databases and designing of information systems.

Shri T.N. Seshan, the then Member, Planning Commission and presently the Chief Election Commissioner of India, inaugurated the conference. In his address he emphasized the importance of data management and quoted a number of examples relating to the collection of massive data and their under-utilization. He described the importance of data in effective planning for the development of the nation and stressed the need for evolving data management techniques that would make the access of meaningful data easier to the user. He suggested that scientists, in addition to making the hardware or software user friendly, should also think of means that would make the data more user-friendly. He desired that COMAD-91 should concentrate on these aspects of data management.

Dr N. Seshagiri, Director General, National Informatics Centre (NIC), in his keynote address emphasized on the need of distributed databases and their access through a computer network. NIC is already establishing a comprehensive Governmental Information System with more than 400 distributed data centres in the country, linked through a satellite network.

Prof. T.Viswanathan, Director, INSDOC, and Conference Chairperson in his welcome remarks

brought out the importance of data management in the context of present information explosion. He pointed out that the conference would concentrate on data management techniques that are likely to become available a few years from now. Reviewing the performance of various Database Management Systems (DBMS) being employed at present in the management of information data, he asserted that in the wake of very large data to be handled, a need is already being felt to look for the new database organization techniques such as object-oriented databases etc.

Dr Naveen Prakash, Programme Chairperson, presented the details of the conference. A total of 62 papers were received, of which 19 were finally selected for inclusion in the proceedings. These papers covered topics like specialized databases including hypertext systems, fuzzy data systems, query systems, distributed or federated systems and the object-oriented systems. The papers presented a futuristic trend which may find application five years from now.

About 75 delegates including 20 from USA, Sweden, Japan, Switzerland, France and Italy attended the conference.

On the last day of the conference a panel discussion was held on the theme : 'Data Management - The Next Decade'. The panelists included: Shri N. Vittal, Secretary, Department of Electronics (Chairman); Dr P.P. Gupta, Chairman and Managing Director, CMC Ltd; Dr S.S. Murthy, Director, Defence Scientific Information & Documentation Centre (DESIDOC); Prof. B.N. Jain, Professor, Department of Electronics & Computer Sciences, IIT, Delhi; Prof. C. Rolland, Professor, University of Paris, France and Prof. T. Viswanathan. The other participants included eminent persons from the government, academia and industry. Many problem areas in the data management and the feasible solutions to these problems were discussed. The panelists suggested that the ultimate aim should be to develop idiot user-friendly software rather than user-friendly. Moreover, the use of graphics and the increasing



Shri T N Seshan delivering the inaugural address

use of natural language, information networks will become friendlier.

## **CSIR and UGC sign MoU to tap each other's capabilities for mutual benefit**

The Council of Scientific & Industrial Research (CSIR) and the University Grants Commission (UGC) have entered into an agreement to tap each other's capabilities for their mutual benefit. A Memorandum of Understanding (MoU) to this effect was signed by Dr A.P. Mitra, Director General, CSIR and Prof. Yash Pal, Chairman, UGC, on behalf of their respective organizations on 5 February 1991. This understanding will enable these organizations to have fruitful interaction between universities and national laboratories. It will involve greater participation of the university system in the research and development activities of CSIR and of CSIR, in the activities of the universities, leading to the betterment of each other's expertise and infrastructure, human resource development, exchange of ideas and concepts and techniques which will be of immense mutual benefit.

In order to achieve this aim, these organizations will establish a 15-member joint coordination body. The Chairman of UGC will act as a Chairman of the body. The Director General of CSIR will be the co-Chairman. The Vice-Chairman of UGC; three Directors of national laboratories; three Vice-Chancellors (to be nominated by UGC); three eminent scientists (to be nominated by Chairman, UGC and DG, CSIR); Secretary, UGC; and Head, EMR, CSIR, will be the members of this Coordinating Body. The Coordinator of the UGC-CSIR



Dr A.P. Mitra, Director General, CSIR, and Prof Yash Pal, Chairman, UGC, exchanging the MoU

interaction programme will be the Secretary of the body. This Coordinating body will lay down the policy frame of interaction; initiate, promote and approve joint major research and developmental programmes; recommend to respective organizations, the financial provisions that need to be made; overview and monitor the interaction; promote and support joint teaching, research and developmental activities; and take all such steps as deemed necessary to enhance UGC-CSIR interaction.

Under this MoU, CSIR has agreed to develop research programmes between its national laboratories and selected universities in their thrust areas. CSIR will provide research facilities, infrastructure and accessorial facilities, such as library, computer, workshops, to the univer-

sities for their participation in such programmes. UGC, through the university system, will involve CSIR scientists in educational and training programmes and recognize them as guides for work leading to research degrees. UGC has agreed to request university system to provide academic recognition to CSIR scientists by providing them opportunities as Visiting Professors, Adjunct and Honorary Professorships, etc. UGC will also provide free access and promote participation of CSIR scientists in the programmes of the Inter University Centres/Consortium. In return, CSIR has agreed to evolve suitable associateship programmes for the university faculty members. Under this clause, the faculty member can visit CSIR laboratories for short periods.

## **CGCRI develops Improved Mud Chulhas with Ceramic Liners**

The National Programme on Improved Chulha (NPIC) was launched by the Department of Non-Conventional Energy Sources (DNES), New Delhi, under the minimum need programme of the Government of India in 1983. Under this programme, over 80 lakh improved mud chulhas, fixed

and portable types as well as family and community types, have been installed throughout the country matching with the cooking habits and the fuel availability in different regions of the country.

However, all these mud chulhas had inherent problems of low durability, non-retention of dimen-



Fabrication of ceramic liner on traditional potter's wheel



Fabrication of ceramic liner by improved Jigger & Jolly method

sion during repeated use and loss of heat in the heavy mud structure.

The Technical Backup Support Unit of the Central Glass & Ceramic Research Institute's, Khurja Centre, U.P., has improved the durability and retention of dimension of chulhas through incorporation of prefabricated ceramic liners having high mechanical strength, low thermal

mass, low conductivity and high thermal shock resistance properties. Ceramic liners for improved chulhas are the inner hot face containers which satisfy the severe and continuous thermal loading during the period of cooking for several hours.

The raw material composition, design and fabrication technique for the ceramic liners were standardized for commercial production.

The raw materials (common clays, plastic fireclays and ball clays) are easily available and of low cost. The additives used are red clay grog, low-grade talc (soap stone), fireclay grog, silica and agrowastes like rice husk, rice husk ash, saw dust, etc.

The fabrication technique using the method of jiggering and jollying in plaster of Paris moulds has several advantages over the conventional methods, which include: (a) adaptability by unskilled potters, (b) high dimensional accuracy and uniformity of ceramic liners, (c) reproducibility in commercial production, (d) increased productivity, and (e) significant reduction of manual labour.

For firing the ceramic liners at a moderately high temperature and at a lowcost, suitable to the needs of rural potters, two different types of energy efficient wood-fired kiln were also developed: (a) Improved updraught bottle kiln ( $1050^{\circ}\text{C}$ ) and (b) Improved twin-chambered down-draught kiln (up to  $1050^{\circ}\text{C}$  with wood as fuel). The kilns are superior to the traditional kilns in regard to energy efficiency, rejection of articles and fire hazard.

The appropriate technology package would go a long way in eliminating the human drudgery and improving the economic standard and quality of life of the rural potters.

The technology package was disseminated to the rural potters through fourteen training-cum-demonstration programmes conducted during 1989-90 and around 100 potters deputed from 30 different agencies throughout the country were trained. The training programmes were of 10 days' duration each and comprised technical lectures and practical demonstrations.

Also, a get-together of principal investigators of all the seventeen Technical Backup Support Units (TUBs) throughout the country was



arranged at the Khurja Centre, during July 1989 under the sponsorship of DNES, in which thirty-three persons participated.

## Prospectives of Increasing Yield and Quality in Tea

Reference news item 'Biotechnology in Tea' by Dr R. Singh, former Director, Tocklai Research Station (TRS), Jorhat [CSIR News, 41(1991),6]. Dr Sushil Kumar, Head, Human Resource Development Group, CSIR, and a recipient of Bhatnagar Prize for Biological Sciences (1981), had visited TRS last month, at the invitation of the Tea Research Association. He has conveyed to us some additional points needing immediate attention of the tea research workers:

### New Planting Material Required

Various economic criteria already pointed out by Dr Singh dictate that yield should remain the main objective of tea breeding. Accordingly, selection should be exercised for large leaf and 2 or 3+ bud plucking size, at all stages of breeding programmes.

Since existing bushes in the Assam plantations represent the bulk of genetic variability in tea, rapid techniques should be devised for screening a very large number of bushes for their yield determining traits, response to applied chemical fertilizer and degrees of susceptibility to various pests and diseases. These tests should also prove useful in evaluation of potential of young plants. It will also be desirable to identify plants in which the 3rd leaf from bud has desirable tea-quality characteristics.

Another culture should be used to derive homozygous lines possessing different combinations of desirable genes. The new lines

should be studied for their general and specific combining abilities. This approach will provide opportunities for exploiting heterosis to a fuller extent.

Cell cultures should be used for selection of new types, such as those possessing draught tolerance, improved NPK uptake characteristics, disease resistance, increased content of specific substances determining quality or and for human nutrition (vitamins, etc.).

Protoplast fusion technology offers opportunities for the development of improved cybrids, triploids and tetraploids. There is an opportunity to exploit foreign genes for solving specific agronomic problems. Crystal protein genes of *Bacillus* sp might prove useful in controlling certain pests of tea. Similarly, antisense genes for ethionine synthesis pathway in plants might provide a way for controlling growth in tea plant.

### Greater Yields from Existing Plant Types

Signal compounds that can elicit tolerance towards diseases require to be identified. Specially constructed strains of *Azotobacter chroococcum* may provide means of controlling soil borne pests and pathogens. A growth promoting preparation of nutrients is also required.

### Quality of Tea

Quality of tea depends on the genotype of plant, environmental conditions of growth and processing of harvested material. Withering and fermentation are the processing techniques used on harvested young shoots for eliciting chemical characteristics required in a drinkable tea. It appears that processing involves partial dehydration and injuring of living tissues and retention of injured tissue at room temperature for several hours. Clearly, stress of the environment and of processing

must be responsible for inducing the expression of certain critical steps of biochemical pathways of tea leaf cells responsible for chemicals involved in flavour, colour and strength of liquor. Knowledge about chemical nature of induction mechanism or switch for these pathways will help in controlling the quality of tea at the processing stage. This approach may help in improvement of both quality and yield of tea in a short span of time.

## Method for Selection of Coal Mining Machine

The Central Mining Research Station (CMRS), Dhanbad, has evolved a method to define workability of Indian coal seams. This will help in selection of suitable coal mining machinery and its energy requirement.

For the evaluation and standardization of the method, a large number of laboratory and field experiments were carried out. Laboratory as well as field strength properties of coal seams, drillability as well as cuttability of coal and various geological features like bands, cleats, etc., present in coal seams were found out. Evaluation of specific energy consumed for coal cutting by shearers operating over a number of longwall faces was done and cuttability and specific energy tests were performed in the laboratory using microprocessor-linked hydraulic coal plough rig over more than 30 large coal samples collected from various coalfields of India. The data collected from various laboratory and field experiments were analyzed with the help of computer and an equation was developed for predicting the laboratory cuttability index.

The best predictor equation for specific energy (SE) for coal cutting obtained is:

$$SE = 8.7875 + 1.2253 \times 10^{-7} (X_1)^3 + 2.04285 (X_2)^{1/2} + 9.77724 (X_3)^3 - 5.1532 (X_4)^3$$



Electro-hydraulic coal plough rig for cuttability study

Where,  $X_1$  = *in situ* compressive strength (obtained from Rebound Number), ( $\text{kg}/\text{cm}^2$ );  $X_2$  = laboratory drillability rate of coal block using micro bit ( $\text{mm}/\text{min.}$ );

$X_3$  = protodyakonov strength index; and  $X_4$  = bulk density of coal ( $\text{g}/\text{cm}^3$ ).

The predicted values from this equation have been found to be in good agreement with the experimental values of specific energy with correlation coefficient of 96.47%.

Another relationship was developed to predict field specific energy requirement for coal cutting as a function of laboratory specific energy, frequency of cleats of coal seams, depth of cover (which affects general stress conditions underground) and thickness of extraction over a longwall face. The best predictor equation for *in situ* specific energy ( $\text{MJ}/\text{m}^3$ ) for coal cutting has been obtained as :

$$\text{SE} = 18.283 - 1.305 \times 10^{-2} (Y_1) - 0.1734 (Y_2) - 9.834 \times 10^{-3} (Y_3) - 4.143 (Y_4)$$

Where,  $Y_1$  = laboratory specific energy obtained from instrumented cutting test ( $\text{MJ}/\text{m}^3$ );  $Y_2$  = frequency of cleats of coal seam

(number/m);  $Y_3$  = depth of working of seam (m); and  $Y_4$  = thickness of extraction over longwall face (m).

Predicted values of the field specific energy required for coal cutting using this equation have been found in good agreement with the measured values of specific energy for a number of operating longwall faces with correlation coefficient of more than 95%.

Thus, with these equations, it is possible to predict the field specific energy required by the shearers for cutting a particular coal seam to a sufficiently reasonable degree of accuracy.

### Sealed-off Mine Reopened by Flushing Liquid Nitrogen

Following an incidence of fire in S4 panel of Jambad bottom seam, J.K. unit at Madhujore colliery of ECL was sealed off at pit top, causing a production loss of about 300 tonnes of coal per day and rendering 800 workers idle. Considering the extent of fire, damage caused by two fire damp explosions in the mine after sealing and complex geometry of mine layout, it would have certainly taken more than a year for fire to die down completely. The Central Mining Research Station (CMRS), Dhanbad, and the mine management made a joint effort to recover the mine at the earliest possible for keeping the losses, to a minimum. For this purpose, a small field laboratory having all the facilities for analysis of air samples, monitoring of temperature and pressure of sealed



Status of fire of the sealed area being monitored from the surface bore hole at J.K. unit of Madhujore Colliery

area from surface was set up at the mine premises by CMRS.

A borehole (150 mm diam., and 150 m deep) was drilled from surface up to Kajora seam near the seat of fire, to monitor the temperature and for drawing air samples. All the air samples were carefully analyzed in the CMRS field laboratory. Temperature and pressure inside the pits were also regularly measured. The results of air sample analysis were carefully assessed for explosibility considering effect of all combustible gases present using a computer program developed at CMRS based on Ellicot's extension of Coward's diagram.

On the basis of interpretation of results, it was decided to flush liquid nitrogen through the borehole for lowering the temperature and oxygen content of mine environment. Accordingly, about 4000 litres of liquid nitrogen was poured into the mine through the borehole. Temperature of the sealed area near borehole bottom recorded a fall of about 6.0°C after this operation. Results of subsequent monitoring of all variants showed gradual improvement in the condition of the mine. Within next two months of the above operation concentration of CO went down from 190 to 15 ppm. CO/O<sub>2</sub> deficiency ratio reduced from 0.097 to 0.0065%, CH<sub>4</sub> reduced to nil from 0.14% and percentage of O<sub>2</sub> recorded a fall from 3.75 to 0.91. All these results indicated that the condition had become favourable for reopening the mine. Accordingly, DGMS granted permission for reopening the pits and the mine was reopened after three and a half months of closure. During recovery operations, CMRS field laboratory carried out extensive analysis of air samples sent by rescue personnel continuously for 48 hours.

## Design of Supports for Mine Roadways

Design of supports for underground roadways is a major problem for the mining industry. The Central Mining Research Station (CMRS), Dhanbad, carried out investigations to develop reasonably accurate predictive norms for estimation of rock pressure and strata deformation encountered in mine roadways. Fifteen coal mines at different depths and varying strata conditions were selected for rock mechanic instrumentation. The support pressure and strata deformation in these mines were monitored over a period of two years. Laboratory tests were also conducted to determine the physico-mechanical properties of rock mass of these mines. A numerical modelling using finite element analysis was also done to find out the maximum deformation in the roadways.

It was possible to correlate the maximum deformation (C in mm) with rock dry density ( $\gamma$  in ton-

nes/m<sup>3</sup>), width of the gallery (W in m) and Rock Mass Rating (RMR) using statistical regression, and the following formula was evolved.  
$$C = 40\sqrt{W \gamma^{1/3} (1 - \text{RMR}/100)^3}$$

Similarly, an effort was made to correlate the maximum rock pressure (P) with  $\gamma$ , W and RMR. And the earlier formula developed by CMRS for rock pressure was reestablished.

$$P = W\gamma (1.7 - 0.037 \text{ RMR} + 0.0002 \text{ RMR}^2)$$

The ground support interaction curve as a main criterion for design guidelines was being developed for different strata conditions. As a result, guidelines might be provided for support requirements based on these studies with a view to selecting most suitable support system. Selection of roof supports on the basis of these guidelines would lead to more rational and reliable design strategies.

A few new type of support systems like modified recoverable type roof bolt, rope truss system, roof truss system using truss bracket,



Measurement of load on steel arches using electronic load cells at Sudamdih Colliery

recoverable type roof truss, telescopic prop, yielding U-section steel prop, and yielding type pit prop were designed for the above investigations.

### **Process for Preparing Unwrinkled Green Pepper**

The Regional Research Laboratory (RRL), Trivandrum, has developed a novel process for the preparation of unwrinkled green pepper from immature fresh pepper.

The process involves the inactivation of the poly-phenol oxidase enzyme by boiling water blanching as an initial step. The product is then subjected to a temperature processing for a few hours and dried by conventional drying method at a temperature reasonably above the ambient condition.

The product is green in colour, crisp in nature, does not undergo reduction in volume, and regains almost the original fresh appearance when hydrated. This value-added product can find good export market as the demand for naturally appealing products, without chemical treatments, is increasing in general and for flavouring materials like spices, in particular.

### **Palm Oil Extraction using Microwaves**

Microwaves are used in ovens for heating applications. The Regional Research Laboratory, Trivandrum, has developed an entirely new application for microwaves, i.e. in the processing of palm oil. Shri P.P. Thomas, Dr N. Gopalakrishnan and Dr A.D. Damodaran have succeeded in using microwaves for inactivating the lipolytic enzymes present in the oil palm fruit in short duration exposures. Simultaneously, the strongly attached fruits are loosened from the spikes of the fruit bunches. In the conventional processing these are

achieved at pressures of 45 lb/inch of steam applied for 45 min. Free fatty acid content, an important quality parameter, was found to be as low as 0.5%.

The studies conducted so far on a bench scale have shown that some of the unit operations in the

conventional palm oil extraction processing as well as palm kernel oil extraction are eliminated in the microwave route for oil extraction. This novel route also obviates effluent problem. In addition, microwaves have also been successfully applied in the activation of the rice bran lipase.

## **Solitons and Chaos in Nonlinear Dynamical Systems**

**Prof. M. Lakshmanan's Bhatnagar Prize-Winning Work\***

During the past three decades there has been a revolutionary change in our understanding of dynamical systems. This is mainly due to the realization that nonlinearities present in the system can drastically alter the system behaviour, giving rise to remarkably new (i) coherent and stable structures such as solitons, (ii) chaotic structures which are often fractal in nature, and (iii) new patterns as



systems during the past twelve years or so. His investigations on nonlinear excitations in magnetic systems have shown that the one dimensional Helsenberg ferromagnetic spin chain in its continuum limit is a completely integrable solitonic system and is equivalent to a nonlinear Schrödinger equation. This has opened up new avenues in the research of solitons in magnetic systems, including higher dimensions and damping. Extending these results, he proved that a large class of soliton systems are related to the motion of a nonlinear string and embedding problem of surfaces in differential geometry.

A systematic study of the invariance and symmetries of nonlinear dynamical systems by Prof. Lakshmanan and his group through Lie, Lie-Bäcklund symmetries and Painleve' analysis has shown their connection to the complete integrability and solitonic nature. His analysis on the singularity structure of coupled nonlinear oscillators has shown for what parametric values the systems have regular motion and how chaos sets in. He has also shown that using generalized Lie symmetries involving velocity dependent terms integrable finite dimensional nonlinear systems can be directly identified.

His group has also made substantial contribution to chaotic dynamical systems. In classical

an interplay of coherence and chaos.

Prof. M. Lakshmanan and his group at Tiruchirappalli have been making many faceted and deep investigations of the mathematical structures underlying the soliton and chaotic nonlinear dynamical

\*Prof. M. Lakshmanan of the Department of Physics, Bharathidasan University, Tiruchirappalli has been chosen for the 1989 Shanti Swarup Bhatnagar Prize in Physical Sciences (along with Prof. R. Madusudhana of the Raman Research Institute, Bangalore [CSIR News, 40(1990), 222 & 41(1991), 14].

chaos various bifurcations, routes to chaos and characterization of regular and chaotic motions in Duffing type oscillators, Bonhoeffer-van der Pol oscillator. Rydberg atoms in external fields, perturbed solitonic systems and electrical circuits with nonlinear physical elements have been studied. Analytical determination of onset of chaos, singularity structure analysis and nature of basin boundary structure have also been investigated. He has also contributed to the understanding of integrability aspects in quantum chaos. Prof. Lakshmanan's group is also currently involved in the study of controlling chaos, onset of patterns and quantum chaos in Rydberg atoms and spin systems.

In addition, Prof. Lakshmanan and his group have contributed substantially to the understanding of quantum anharmonic oscillators, diamagnetic Kepler problem, wave propagation in nervous systems and similarity solutions of the Einstein-Maxwell equations in general relativity. Along with Prof. P.M. Mathews, he has also clarified the nature of apparent visual forms of fast moving objects in special relativity.

Prof. Lakshmanan took his B.Sc. (1966) and M.Sc. (1969) from the affiliated colleges of University of Madras, Post M.Sc. Diploma in Theoretical Physics (1970) and Ph.D. (1974) from the Department of Theoretical Physics, University of Madras. Later, he joined the University of Madras, Autonomous Post Graduate Centre, Tiruchirappalli, as a Reader in Physics in 1978, which became Bharathidasan University in 1982. Since 1985, he has been a Professor of Physics here. He has visited several leading universities and institutes of various countries including Australia, Canada, Western Europe and USSR and has organized several national and international meetings in Nonlinear

Dynamics. He was an Alexander van Humboldt Fellow (1976-77, 82) in Germany, Post-doctoral Fellow at Eindhoven University of Technology, Holland (1977-78), Royal Society-Nuffield Foundation Bursary Fellow, UMIST, UK (1979-80), Swedish Natural Science Council Visiting Guest Scientist (1981) and Japan Society for Promotion of Science Fellow, Kyoto University (1984-85).

He is a Fellow of the National Academy of Sciences, India and the Indian Academy of Sciences, a member of the National Board for Higher Mathematics and a Councillor of the Plasma Science Society of India. He was a UGC Career Awardee (1980-83), recipient of the Raman Research Prize, Gold Medal, University of Madras 1979 and the Best Teacher Award of the Government of Tamilnadu (1984).

He has about 85 research papers to his credit and edited/co-edited three books published by Springer-Verlag/Manchester University Press.

## PROGRESS REPORTS

### CDRI Annual Report: 1989-90

The Central Drug Research Institute (CDRI), Lucknow, during 1989-90 continued to make concerted efforts towards the development of new drugs, antifertility agents, immunodiagnosics and vaccines, and to provide various services to academia, government and non-government organizations and the Indian drug industry. Wockhardt Pvt. Ltd, Bombay, produced 45 tonnes of dextroproxyphene hydrochloride (DHC) based on a technology developed by CDRI; the production of DHC has effected foreign exchange saving through import substitution of internal demand (20 tonnes) and has resulted in earning of foreign exchange through export

(25 tonnes) to 11 countries including USA, UK, Switzerland, France, etc. Gugulipid (hypolipidaemic) developed by CDRI and marketed by CIPLA Ltd, Bombay, under the trade name Guglip fared well in the market. During the year, the Guglip sale was worth Rs 5 million. Gugulipid has been licensed to Arkopharma Laboratories, France, for marketing to EEC member countries.

The external cashflow during the year 1989-90 was Rs 30.45 million which constituted 33% of the total Institute's budget of Rs 96.95 million.

The progress of the various research projects of the Institute, during 1989-90, is presented here:

### Drugs

The oral contraceptive, Centchroman, completed extended phase III trials in 125 women volunteers at 30 mg weekly dose and in 87 women at a new 30 mg biweekly regimen at 7 state medical colleges and 6 family welfare clinics at Lucknow; no adverse effects were observed. Ultrasonographic examination showed the ovarian size within normal range. Phase III trials of Centchroman for the treatment of advanced cancer of breast are in progress at Bangalore, Bombay, Delhi, Lucknow and Varanasi centres.

Centpropazine, an antidepressant, was cleared by the Drugs Controller (India) for carrying out phase III clinical trials.

Phase IV clinical study to monitor the efficacy and adverse effects of Centimizone, an antithyroid, progressed well at the Department of Surgery, K.G's Medical College, Lucknow and Department of Endocrinology and Metabolism, AIIMS, New Delhi. Patients suffering from hyperthyroidism showed remission in most cases and partial remission in some cases at the Lucknow centre; the achievement of euthyroid state



was indicated by decline in T<sub>3</sub>, T<sub>4</sub> and TSH levels. At the Delhi centre, half the cases had clinical remission and some other cases showed partial response.

Electromechanical monitoring of chandonium iodide (neuromuscular blocking agent) induced muscle relaxation was completed and the data submitted to the Drugs Controller (India) for permission to conduct phase III trials.

Phase I multiple dose study of Compound 80/574 (hypolipidaemic) showed that the compound is well tolerated at 400 mg/day without any change in biochemical parameters or other side effects.

Single dose phase I clinical trials of compound 80/53 (antitrelapse antimalarial) were completed in G6PD non-deficient human volunteers; the compound was well tolerated and appeared to be safe. In animal studies, it was found to be four times less active than primaquin in producing methaemoglobinemia.

Arteether ( $\alpha/\beta$ ), an antimalarial compound derived from artemisinin, was cleared by the Drugs Controller (India) for phase I clinical trials as a new schizonticide for treatment of cerebral malaria and drug resistant *Plasmodium falciparum* cases. Single dose phase I clinical trials were completed. Arteether was found to be active against *P. cynomolgi* B at a lower dose compared to B-artether. Both arteether and B-artether were found to sterilize gametocytes of *P. cynomolgi* B in rhesus monkeys; oocyst development was completely inhibited rendering the mosquitoes non-infective.

Sodium artelinate and were found to be curative as blood schizontocidal agents against *P. knowlesi*. B-Sodium artelinate showed strong gametocytocidal activity against *P. cynomolgi* B infection in rhesus monkeys and

inhibited oocyst development in mosquitoes.

Seeds and leaves of *Nyctanthes arbortristis* showed significant antileishmanial activity against *Leishmania donovani* in hamster in addition to antiviral, antifungal, antimalarial, antiamoebic, immunostimulant and hepatoprotective activity. The iridoid glycoside responsible for antileishmanial activity was isolated and characterized. The compound also appeared to be an interferon inducer. Arbortristose A and C isolated from the plant showed protection against EMC, SF and vaccinia viruses *in vitro*.

Bacosides A&B (memory and learning facilitatory agents) were found to produce facilitatory effects on experimental schedules in complex learning paradigms, using both negative and positive reinforcements and were under safety evaluation.

Search for bioactive substances from marine organisms led to isolation from the alga *Ulva fasciata* of a compound, 2-amino-1, 3, 4, 5-tetrahydroxyoctadecane, which showed marked protection against EMCV in mice.

Other promising compounds under development include:

Compound 82/437 (antifilarial) — It showed enhanced adulticidal activity against *Acanthocheilium viteae* in order to avoid alteration by gastric mucosa. Gastric resistant granules of the compound were prepared and were being evaluated in rodents; the compound acts by inhibiting glucose uptake and its conversion to lactic acid and by affecting antioxidant defence enzymes of adult filariids.

Compound 85/92 (antiulcerogenic). The compound significantly reduced the incidence of drug-induced ulcers in stomach, duodenum and jejunum in rat and pentagastrin stimulated total and free acid in cat. The compound induced gastric mucin secretion and was well absorbed orally.

Compound 72/207 (local anaesthetic). An analogue of Centbuclidine, it was found to be 16 times more potent than the parent compound and 80 times more active than lignocaine. It also exhibited a longer duration of analgesia than both the standard compounds.



Polygraph instrument at CDRI, Lucknow



Picroliv (hepatoprotective) is a standardized extract, containing picroside I and kutkoside as the major constituents, obtained from *Picrorhiza kurroa* root and rhizome. It showed activity against a wide range of hepatotoxins and *Plasmodium berghei*. Its choleric and anticholestatic activities were established. It was found to be significantly effective against HBs and EMC viruses. It showed immunostimulant activity against *Leishmania donovani*. The data on Picroliv were submitted to the Drugs Controller (India) for permission to conduct phase I clinical trials.

Two chromatographic fractions from seed kernel of *Caesalpinia bonducella* showed potent macrofilaricidal action against *Brugia malayi* in rodent. Macrofilaricidal activity of the traditional remedy *Streblus asper* was traced to two glycosides, asperoside and strebloside.

An antiurolithiatic principle, lupeol, was extracted in high yield from *Crataeva nurvala*, and was being experimentally evaluated.

#### Vaccines/Immunomodulators

*Mycobacterium habana* leprosy vaccine (developed earlier by the institute) was found to change 75% of lepromin negative rhesus monkeys to lepromin positive status. It was found to be safe in acute and subacute toxicity studies in rats and rabbits; the data were submitted to the Drugs Controller (India) for permission to initiate phase I clinical trials.

Out of five fractions obtained from *M. habana*, peptidoglycon protein complex exhibited better delayed type hypersensitivity response to *M. leprae* antigens indicating that the antigenic moiety may probably reside in this fraction.

Rabbits vaccinated with a surface protein (22 KD) of *Vibrio cholerae*, characterized as adhesive

antigen earlier, detoxified cholera toxin and 22 KD protein + detoxified cholera toxin on challenge with virulent *V. cholerae* strain showed 85, 38 and 100% protection respectively. All protected rabbits were found to show normal ileal loops without any diarrhoeal fluid.

Murine Interferons (MuIFN -  $\alpha$  /  $\beta$ ) and IFN inducer (Poly I:C) were found to provide significant protection in Swiss and Balb/c mice against *Candida albicans*. MuIFN was found to be protective and therapeutic; the protective effect was, however, inoculum and dose dependent. Protection was also obtained in *Aspergillus fumigatus* keratitis.

#### Diagnostics

Filariasis diagnostic kit developed at CDRI for detection of early cases of filariasis was released to Malladi Drugs & Pharmaceuticals Ltd, Madras, for commercialization.

Immunodiagnostic tests (IFA & Dot-ELISA) for detection of leishmaniasis (kala-azar) were found to be highly sensitive and specific for diagnosis of kala-azar in a pilot clinical study.

#### Basic Research

Significant leads were identified involving anti-oxidant enzymes and polyaniline uptake mechanism of filarial parasites as biochemical targets for development of better antifilarial compounds.

A proaggregatory factor of low molecular weight protein was found in mouse plasma; the factor is calcium dependent and inhibited by increasing the cellular cAMP levels.

Serotonin (5-HT) induced peripheral inhibitory effect was demonstrated for the first time. 5-HT produced biphasic response on the isolated colon of mastomys: initial relaxation was followed by contraction. Specific 5-HT<sub>1</sub> receptor antagonist, methysergide,

blocks Ca-independent relaxant effect mediated via 5-HT<sub>1</sub> receptors.

Studies on erythrocyte membrane demonstrated that both membrane skeleton-bilayer interactions and ATP-dependent aminophospholipid pump are required for maintenance of the asymmetric transbilayer phospholipid distribution in erythrocytes.

Studies on major integral membrane proteins of *P. knowlesi* infected monkey erythrocytes showed that erythrocyte anion channel protein does not undergo any major structural changes during malarial infection.

*Bacillus sphaericus* (mosquito larvicide) formulation was found to be effective against larvae of *Culex* and *Anopheles* mosquitoes in several field studies. The formulation did not show any significant deterioration on storage in polythene packets at room temperature.

Liposomal preparation of stibamate against leishmaniasis in hamsters was found to be more effective than the unliposomal drug.

The national centres functioning at CDRI continued to render R&D services in their respective disciplines; these centres are: ICMR Centre for Advanced Pharmacological Research on Traditional Remedies, WHO Collaborating Centre for Preclinical Evaluation of Antimalarials, National Laboratory Animal Centre, National Sophisticated Instrumentation Centre, Parasite Bank and the National Information Centre for Drugs and Pharmaceuticals.

During 1989-90, 202 papers were published in journals, and seven chapters were contributed in books/monographs.

## **Prof. V.S. Rama Das takes over as Director, CSIR Complex, Palampur**

Prof. V.S. Rama Das, Professor, School of Life Sciences, University of Hyderabad, Hyderabad, has been appointed Director of the CSIR Complex at Palampur (H.P.), with effect from 1 January 1991.

Prof. Rama Das (born 5 Feb. 1933) did his M.Sc. from the Delhi University (1953), D. Phil. from the Oxford University (UK) (1957), and Post Doctoral research at the California University (USA) (1959-60).



Prof. Rama Das has about 34 years of teaching/research experience. After serving as Assistant Professor of Botany at the University of Allahabad from 1957 to 1959, he joined Sri Venkateswara University (SVU) becoming Professor in 1970. At SVU he served as Professor & Head, Department of Botany (1970-83), Professor & Chairman of Board (1983-88), Vice-Principal for Sciences (1977-78), Dean of School of Biology & Earth Sciences (1981-83), Dean of Faculty of Sciences (1983-88), Principal of S.V. College of Arts & Sciences (1983-84), Member of University Syndicate as Senior Professor (1985-86), Member of University Executive Council (1988-89) and Rector of the S.V. University (1986-87). In between he also served as Associate Professor of Biology at the Memorial

University of Newfoundland, Canada (1967-69), and as Professor and Director of Centre for Photosynthesis, University of Hyderabad (1978-80) (on lien from S.V. University).

He left the Sri Venkateswara University in 1989 to join the University of Hyderabad, where he worked as Professor of School of Life Sciences, till the present appointment.

He was elected Fellow of the Indian Academy of Sciences in 1975 and of the Indian National Science Academy in 1978. He was President of the Indian Society for Plant Physiology in 1973 and of the Andhra Pradesh Academy of Sciences in 1978-79, Editor-in-Chief of *Indian Journal of Plant Physiology* in 1977-78 and Member, Executive Committees of Indian Science Congress Associations in 1983 and 84. He is on the editorial boards of *Indian Journal of Experimental Biology* and *Proceedings of Indian National Science Academy—Part B*.

Prof. Rama Das has been a member of a large number of expert committees of the various S&T autonomous bodies/government departments which include CSIR, DAE, DNES and DST. He was chairman of the panel for Plant Physiology (ICAR), and is an RAC member of the Birbal Sahni Institute of Palaeobotany, CSMCRI and CIMSP.

Prof. Rama Das is recipient of many prestigious honours and awards which include: FICCI Award for Outstanding Achievement in Life Sciences (1978), Meritorious Teacher Award of Andhra Pradesh Government (1981), J.J. Chinoy Medal in Plant Physiology (1978), UGC National Lecturer in Botany (1978-79 & 1985-86), Birbal Sahni Gold Medal (1985), S.M. Sircar Memorial Medal (1986) and Watumull Honor Summus Medal (USA) (1987).

A widely travelled man, Prof. Rama Das has visited several research institutions in UK, USA, USSR, Sweden, Canada, Australia, New Zealand, Greece and Switzerland.

He has 210 publications in plant physiology, and 19 students who worked under his guidance have received their Ph.D. degrees.

## **Shanti Swarup Bhatnagar Prizes in Science and Technology for 1991**

Nominations are invited by the Council of Scientific & Industrial Research for the Shanti Swarup Bhatnagar Prizes in science, including engineering and technology for 1991. The prizes are to be given for research contributions made primarily in India during the past five years. The upper age limit of nominees for the prize is 45 years.

The prizes, each of the value of Rs 50,000, may be awarded annually for notable and outstanding research, applied or fundamental, in the following disciplines: (1) biological sciences, (2) chemical sciences, (3) earth, atmosphere, ocean and planetary sciences, (4) engineering sciences, (5) mathematical sciences, (6) medical sciences and (7) physical sciences.

Nominations should be sent as per the prescribed proforma by 1 April 1991. Regulations governing the prize and the proforma for nomination may be obtained from the Head, Human Resource Development Group, Extramural Research, CSIR Complex, Pusa, New Delhi 110 012.

### **Corrigendum**

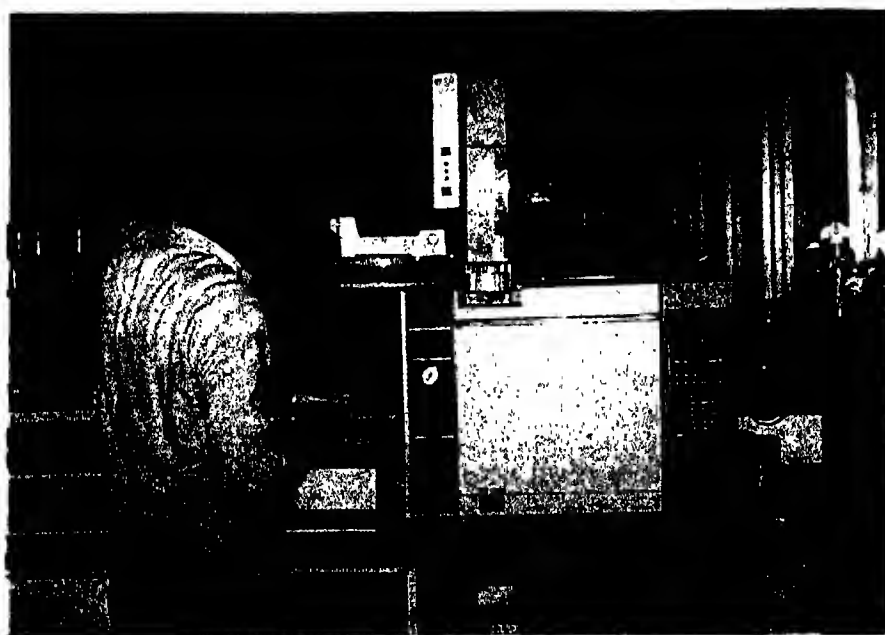
In the news item 'CSIR Technology Awards', published in *CSIR News*, 40(1990), 220, please note that CSIR Technology Awards were for the year 1990 and not for 1989.

# CSIR NEWS



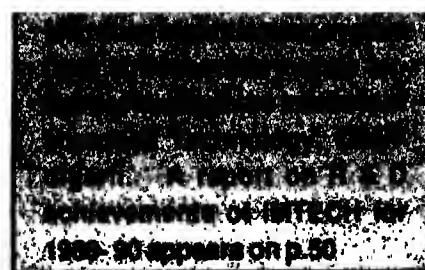
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## IN THIS ISSUE

- Shanti Swarup Bhatnagar Prizes  
1990 51
- Studies on *recA* and *umuDC*  
Gene Complex of *Vibrio*  
*cholerae* 52
- The Science and Applications of  
Liquid Crystals  
—Prof. N.V. Madhusudana's  
Bhatnagar Prize-winning Work 53
- Structural Ceramics for Launch  
Vehicles & Satellites - Paper  
presented by Dr B.K. Sarkar at  
ISAC-90 54
- DBT-sponsored Training Course  
on Tissue Culture at CIMAP 55
- Training cum Demonstration  
Programmes on Ferrocement  
Technology in Karnataka 56
- Dr S.R. Gowarikar Director  
CSIO, retires 58
- Dr G.P. Phondke awarded  
NCSTC National Award for  
Best Science & Technology  
Coverage in Mass Media 58
- NISSAT-INSDOC Courses on  
Computer Application to  
Library & Information Activities 58
- Nominations invited for CSIR  
Young Scientist Awards for  
1991 60



A report on R & D  
Achievements of CSIR for  
1989-90 appears on p.50

# INSTITUTE OF MICROBIAL TECHNOLOGY, CHANDIGARH

## R&D Highlights: 1988-90

The thrust R&D programmes of the Institute of Microbial Technology (IMTECH), Chandigarh, during 1988-90 were concerned with: (1) Industrial ethanol fermentation: Construction of improved strains by genetic manipulation and process optimization; (2) Rifamycin fermentation: Genetic and biochemical approaches for approved process development; (3) Isolation and purification of plasminogen activators from animal cells and cloning of plasminogen activators coding sequence in *E. coli*; (4) Selective delivery of antileishmanial drugs to macrophages; (5) Novel petroleum exploration strategies: A feasibility study for developing genetic and immunological approaches for detection of oil bearing formations; (6) Regulation of immune system: An approach towards developing B- and T-cell specific immunomodulators; and (7) Construction of vectors for stable maintenance and expression of foreign cloned genes in yeast and study of biological functions of proteins by two essential genes. The national facilities set up at IMTECH are: Biochemical Engineering Research and Process Development Centre; Microbial Type Culture Collection and Gene Bank; and Distributed Information Centre on Enzyme Engineering, Immobilized Biocatalysts, Microbial Fermentation and Bioprocess Engineering.

During the period, technical know-hows related to: (a) an improved strain of *Saccharomyces cerevisiae* for fermentive production of ethanol, and (b) a novel process for enzymic conversion of rifamycin B to rifamycin S, were transferred to the industry.

The improved strain, developed by genetic manipulation, could fer-

ment molasses having initial sugar concentration of 25-30% to produce 12-16% (v/v) ethanol in course of 36-48 h. In comparison to its parent strain, it showed higher osmotolerance, ethanol tolerance and under optimal conditions produced ethanol with an efficiency of more than 90%. The strain could grow well in YPD medium at temperatures up to 37°C. Since it grows well in high molasses concentration (pH 5.0), possibility of its contamination by bacteria is less. For growth and fermentation in molasses, no supplementation was found to be necessary. The stability of the properties of this strain is ensured by the fact that it is homothallic and of high ploidy. The potential impact of this strain on the ethanol industry in India can be gauged from the fact that the strains currently used by most of the 200 distilleries produce 6-8% (v/v) ethanol from a feedstock containing an initial maximal sugar concentration of about 15% (v/v).

The project on rifamycin fermentation was taken up with the twin aims of developing high yielding strains of *Nocardia mediterranei* for the production of rifamycin B by gene cloning and protoplast fusion techniques and a method for efficient microbial transformation of rifamycin B to rifamycin S.

To start with, standard ATCC rifamycin B producing cultures of *N. mediterranei* were obtained and rifamycin fermentation was standardized using different media. A particular low producer strain from a pharmaceutical house was also obtained. Using selection and mutagenesis techniques, a strain which produced 4.2 g/litre of rifamycin B was developed from the latter. The strain, however, was

found to be very stable. Also, a method was developed for easy separation and accurate estimation of rifamycins by HPLC.

A microbe, subsequently identified as *Curvularia lunata*, was isolated from soil which was found to produce an extracellular enzyme, characterized as rifamycin oxidase, capable of transforming rifamycin B to rifamycin S. A process was developed using this strain.

Furthermore, a new method was developed for the screening of rifamycin B producing mutants using the *C. lunata* oxidase. Also, methods for protoplasting and regeneration of different *N. mediterranei* strains were standardized with a view to carrying out electrofusion experiments. Of the two strains taken for fusion studies one was a relatively high producer of rifamycin B in the presence of sodium barbiturate while the other could produce rifamycin B even in the absence of barbiturate albeit at a lower level. These strains were made resistant to viomycin and streptomycin respectively, and fusants resistant to both antibiotics were screened for antibiotic producing capability in the absence of sodium barbiturate. It was found that the fusants at best could produce just as much rifamycin as the parents.

A few rifamycin resistant mutants of *S. lividans* were also isolated so as to use them as hosts for cloning of genes of rifamycin biosynthetic pathway. This was to ensure that the cloning host is able to survive the lethal effect of the antibiotic produced in case all the genes of its biosynthetic pathway cloned therein are expressed efficiently. To exclude the possibility that the cloning hosts thus obtained could be resistant to the antibiotic due to permeability bar-

rier, RNA polymerase assay was performed with the cell free extracts of the mutants in the presence of rifampicin. In five of the mutant extracts, RNA polymerase was found to be active in the presence of rifampicin, thereby indicating that these could be used as potential hosts for cloning rifamycin biosynthetic pathway genes.

Attempts were made to develop an indigenous technology to produce plasminogen activators at a reasonable cost for use in thrombolytic therapy. So far none of the agents used (such as streptokinase, urokinase, tPA, etc.) is produced indigenously. Purification of urokinase from urine was done by placing silica gel columns directly in the urinal. As the urine passed through these columns, most of the fibrinolytic activity was adsorbed on the gel. The bound material was eluted with 4% ammonia solution and further fractionated by ammonium sulphate precipitation. The fractionated material was then passed through a column of amberlite IRC-50. The product obtained was a crude preparation of urokinase. In western countries, a preparation of this purity is marketed for therapy. But it was further purified through an affinity column of monoclonal antibodies against urokinase developed in the institute. This gave a highly purified urokinase with a specific activity of 15,000/PU/mg protein. The cost of this purified urokinase of 25,000 plough units is much less compared to the product of many pharmaceutical companies which produce urokinase of low potency, for therapeutic use.

To conduct scale up studies, trials were conducted in an industrial plant. The design of the columns and the process were standardized and made suitable for commercial applications.

The urokinase therapy is known to cause some undesired degradation of fibrogen in the circulating blood. For preventing this by specifically targetting the urokinase to clot surface, monoclonal antibodies against fibrin were raised. After fusion, five clones were selected, of which one was found to be fibrin specific. In order to get a stable cell line, this highly fibrin specific clone D-4 was subcloned by limiting dilution and ultimately two stable cell lines B-411 and C-511 which secrete human fibrin monomer specific monoclonal antibodies were obtained. The clones have been stable for antibody production for 12 months and secrete nearly 8 mg of pure antibody per 2 ml of ascitic fluid.

Macrophages mainly participate in host defence. But in a number of diseases of viral, bacterial, fungal and parasitic etiology, the causative agents proliferate within the macrophages. Therefore, delivery systems capable of targetting various drugs to the cells of macrophage lineage are extremely useful in the chemotherapy of a large variety of diseases affecting millions of people worldwide.

A targetting rationale for selective delivery of antileishmanial drugs to macrophages was established utilizing the exquisite specificity and high efficiency of the process of endocytosis mediated by 'scavenger receptors' present exclusively on the cells of macrophage lineage. The delivery system designed by IMTECH consists of a polyanionic macromolecule recognized by the scavenger receptors which act as a vehicle to carry drug molecules attached to it inside the cells.

The feasibility of this approach was determined by chemical conjugation of a cytotoxic drug, methotrexate (Mtx) to a macromolecular ligand, maleylated bovine serum albumin (MBSA),

## **Shanti Swarup Bhatnagar Prizes : 1990**

The following ten scientists have been selected for the Shanti Swarup Bhatnagar Prizes for Science and Technology for the year 1990:

**Biological Sciences:** Dr Samir Kumar Brahmachari, Molecular Biophysics Unit, Indian Institute of Science, Bangalore.

**Chemical Sciences:** Dr B.M. Choudary, Scientist, Indian Institute of Chemical Technology, Hyderabad and Prof. N. Sathyamurthy, Department of Chemistry, Indian Institute of Technology, Kanpur.

**Engineering Sciences:** Prof. Sankar Kumar Pal, Electronics & Communication Sciences Unit, Indian Statistical Institute, Calcutta and Dr Gangan Prathap, Scientist, Structural Sciences Division, National Aeronautical Laboratory, Bangalore.

**Medical Sciences:** Dr M.K. Bhan, Department of Paediatrics, All India Institute of Medical Sciences, New Delhi.

**Mathematical Sciences:** Prof. Ramachandra Balasubramanian, Institute of Mathematical Sciences, Madras and Dr S.G. Dani, School of Mathematics, Tata Institute of Fundamental Research, Bombay.

**Physical Sciences:** Prof. Ganapathy Baskaran, Institute of Mathematical Sciences, Madras and Prof. Ajay Kumar Sood, Department of Physics, Indian Institute of Science, Bangalore. □

recognized by scavenger receptors present predominantly on macrophages. It was also shown that the drug conjugate (MBSA-Mtx) binds with high affinity receptors on macrophage surface leading to rapid internalization and subsequent degradation of the ligand in the lysosomes releasing a pharmacologically active form of methotrexate. The drug conjugate was about 100-fold more effective than the free drug in eliminating intracellular amastigotes of *Leishmania* harboured by macrophages. It was also shown that this cytotoxic activity is due to enhanced uptake of methotrexate in conjugated form compared to the free drug. Finally, the drug conjugate brought about more than 90% reduction in the size of footpad lesion within 11 days in an experimental model of cutaneous leishmaniasis in hamsters.

To demonstrate the generalized application of this modality of drug delivery for other macrophage-associated diseases, the bacterial disease, tuberculosis was chosen. In this disease, the causative agent *Mycobacterium tuberculosis* is also harboured by macrophages. It was shown that *p*-aminosalicylic acid (PAS) conjugated to MBSA was nearly 100 times as effective as free PAS in killing the intracellular mycobacteria in mouse peritoneal macrophages infected in culture with *M. tuberculosis*. The killing of intracellular mycobacteria mediated by the drug conjugate could be effectively prevented by simultaneous addition of excess MBSA or chloroquine to the medium whereas these agents did not affect the microbicidal action of free PAS.

Under the programme on Novel Petroleum Exploration Strategies, the institute continued to carry out feasibility study for developing genetic and immunological approaches for detection of microflora diagnostic of oil-bearing forma-

tions. Three propane/butane utilizing bacteria were isolated and purified. Three of them, RKJ 40 (Gram negative), RKJ 35 (Gram positive and identified as a species of *Rhodococcus*) and RKJ 23 (refractory to Gram strain) were selected for detailed study. Two proteins from RKJ 35 and RKJ 40 were purified and used to raise antibody against them.

Western blotting using these antibodies clearly demonstrated that these proteins are specifically induced in presence of propane/butane and these proteins are not detectable in the same strain grown on glucose, propanol or in nutrient broth. Furthermore, antibodies against one of the proteins showed good specificity towards whole cells only when they were exposed to propane or butane.

Studies were also carried out to check whether these proteins were present in other bacteria capable of utilizing propane and/or butane, and to see whether they were components of a bigger protein molecule.

Attempts were continuing to develop genetic transfer systems for the hydrogen-utilizing organisms to get a good expression of genes in their natural host.

The precise mechanism by which accessory cells facilitate T cell activation is not clearly understood. Evidence is available to support the concept that at least two signals are required for activation of T lymphocytes, one signal being provided by antigen occupancy of T cell antigen receptor (TCR) and the other by the soluble material liberated by the accessory cells. In conjunction with these two, a third signal called signal zero provided by APCs is predicted to play a role in activation of T cells. While trying to uncover the mechanism of this signal zero IMTECH isolated membrane proteins from normal peritoneal macrophages, using

SDS polyacrylamide gel electrophoresis. The proteins were eluted from the gel and each protein was tested for its ability to regulate antigen specific B cells in T dependent responses.

In the yeast *S. cerevisiae*, 3'-phosphoglycerokinase is very strong constitutive promoter. A strategy was conceived to regulate the expression of cloned heterologous genes under this promoter, using operator repressor system of bacteriophage lambda. As the first step in this direction, Cl repressor gene lambda was cloned and expressed in yeast. The filter binding assay suggested that the expressed protein was a functional one. The immunofluorescence studies indicated that the protein was largely localized in the nucleus even though a considerable amount of it was also present in the cytosol.

Analysis of the level of transcription of yeast URA3 and TRP1 genes in *E. coli* at different temperatures revealed that the genes under the control of their own promoters also behaved in a temperature dependent manner in *E. coli*. □

### **Studies on *recA* and *umuDC* Gene Complex of *Vibrio cholerae***

To maintain genetic continuity, living cells have different regulatory networks of genes to repair damage to their DNA. Scientists of the Biophysics Division at the Indian Institute of Chemical Biology (IICB), Calcutta, have been studying the strategies adopted by *V. cholerae* cells to repair damage to its DNA for the last several years [CSIR News, 33(1983) 140 & 34(1984) 119]. Studies on error-proof DNA repair mechanisms have shown that *V. cholerae* cells are extremely inefficient in repairing UV-induced DNA damage by the major repair pathway. Examination of the error-prone repair



mechanisms in this organism, which lead to mutations, has resulted in several confusing observations. The error-prone repair activity has been found to be repressed in undamaged wild type cells and expressed as one of a metabolically diverse but coordinately regulated group of inducible functions, in response to UV irradiation or other agents that damage DNA or interrupt its replication. The first regulatory network induced by DNA damage whose regulation is now understood in some detail is the so called 'SOS' network, controlled primarily by the *recA* and *lexA* gene functions. These genes are expressed at a significantly higher level when the cell DNA is damaged. Preliminary studies from this laboratory have demonstrated that *V. cholerae* cells cannot be mutagenized by UV light, and UV-irradiated choleraphages cannot be Weigle reactivated, although UV-induced chloramphenicol inhibitable filamentation of the host cells are observed. All these phenotypic expressions are dependent on functions of genes that are induced following SOS inducing signals.

Shri Subrata K. Ghosh of IICB undertook studies to examine the status of several SOS-induced gene functions in *V. cholerae* cells. He constructed several genomic libraries, and using interspecific complementation of an *E. coli* *recA* mutant with plasmids containing the gene bank of *V. cholerae*, identified the *recA* gene of this organism. His studies showed that the recombinant plasmid pDP145 contains a 1.5 kb segment of *V. cholerae* DNA which codes for a protein of MW 39,000. The product of this gene confers methyl methane sulfonate resistance on the *E. coli* *recA* mutant, suppresses its UV light sensitive phenotype, and exhibits proteolytic activity for the phage lambda repressor. He

demonstrated the induction of the 39,000 Da protein in UV-irradiated *V. cholerae* cells. The nucleotide sequence of the *recA* gene was determined.

Demonstrating the existence of a functional *recA* gene in *V. cholerae* cells for the first time, Shri Ghosh addressed to the problems as to why these cells are UV non-mutable, and UV-irradiated choleraphages cannot be Weigle reactivated. For the SOS responses to occur, in addition to the *recA* gene, several other gene functions, viz. *uvrA*, *umuD* and *umuC* are required. *V. cholerae* cells possess the *uvrA* gene functions, hence Shri Ghosh examined the status of the *umuDC* gene complex in this organism. All his attempts to identify a *umuDC* analog using interspecific complementation of *E. coli* mutants with plasmids containing a gene bank of *V. cholerae* were unsuccessful. The DNA from none of the *vibrio* species examined so far, including marine vibrios, hybridized to *E. coli* *umuC* and *umuD* gene sequences. However, the lack of hybridization of the *E.*

*coli* *umuDC* gene sequence to *V. cholerae* DNA does not necessarily imply that *V. cholerae* cells lack functional analog of these genes. To prove conclusively the lack of *umuDC* gene functions in *V. cholerae*, Shri Ghosh made use of the plasmid pKM101 which carries a gene complex *mucAB* which can complement the *umuDC* functions. The plasmid pKM101 was conjugally transferred to *V. cholerae* cells and it was demonstrated that these cells can now be mutagenized by UV light and Weigle reactivation of UV-irradiated choleraphages becomes possible.

Thus, the studies performed by Shri Ghosh have conclusively established that *V. cholerae* cells lack the *umuDC* gene functions and that these cells have a functional *recA* gene.

Shri Ghosh carried out these studies under the guidance of Dr Jyotirmoy Das of IICB, and was awarded Ph.D. degree in Biochemistry (1990) by the Calcutta University for his thesis based on the studies. □

## The Science and Applications of Liquid Crystals

Prof. N.V. Madhusudana's Bhatnagar Prize-winning Work\*

Liquid crystals have become widely known because of their application in display devices. As the name implies, liquid crystals are intermediate states of matter, sharing some properties like optical anisotropy with crystals and some others, like the ability to flow, with liquids. Indeed, there are many types of liquid crystals, whose

\*Prof. N.V. Madhusudana, Raman Research Institute, Bangalore, has been awarded the Shanti Swarup Bhatnagar Prize in Physical Sciences (along with Prof. M. Lakshmanan of the Bharathidasan University, Tiruchirappalli) [CSIR News, 40(1990)222 & 41(1991)14].



physical properties and response to external stimuli are of immense interest to fundamental physicists. Prof. Madhusudana has been

working in this field for over two decades. His interests range over a wide area of the physics and applications of liquid crystals. Some of his recent contributions are summarized below:

Many highly polar compounds exhibit the following counter-intuitive double reentrant phase sequence as they are cooled: isotropic-nematic-smectic A-reentrant nematic-reentrant smectic. The nematic phase has only an orientational order while the smectic also has a layered arrangement of the molecules in addition. One of Madhusudana's contributions is the development of the first satisfactory molecular theory of this phase sequence by recognizing the importance of permanent dipolar as well as dipole-induced dipolar interaction in such compounds.

Electrohydrodynamic (EHD) instabilities in nematics have been studied for the past couple of decades by several groups. There were several puzzling experimental results like the occurrence of 'oblique' rolls in the low frequency conduction regime and 'longitudinal' EHD instabilities in materials with negative conductivity anisotropy, which could not be explained by earlier theories. It has been shown that flexoelectric effects play an important role in the problem and a theory has been developed by including flexoelectricity. The new model accounts for all the observations. Some experiments have also been conducted to prove directly the importance of the flexoelectric effects in EHD instabilities in nematics. Very recently, it has been shown that by changing the symmetry of the cell by having pretilt angle of the molecular orientation, propagating EHD patterns result under a DC excitation. The prediction has also been confirmed experimentally.

One of the first physical studies on liquid crystals was done by Leh-

mann in 1900 when he found that the chiral symmetry of cholesterics results in a continuous rotation of drops subjected to a vertical temperature gradient. This experiment requires special boundary conditions and has not been reproduced. An analogous effect, viz. electromechanical rotation under the action of a DC electric field was recently demonstrated by devising a very special technique of floating essentially 'flat' cholesteric drops in the isotropic phase. This has enabled the first measurement of electromechanical coefficient in cholesterics. More recently, a linear electrooptic effect has been demonstrated in cholesteric liquid crystals by exploiting the electromechanical effect.

Other experimental results which are noteworthy are: (a) the first demonstration of the coexistence of two nematic phases in a binary mixture of compounds with small molecular weights, one of them having rod-like and the other disc-like molecules. The special configurations of the molecular orientation occurring in such a coexisting region have been used to demonstrate the topological equivalence of point and ring defects in nematics; (b) the first observation of a regular network of point disclinations at the nematic-isotropic interface in suitably prepared samples; and (c) the measurement of the depression in the nematic-smectic A transition point caused by a distorted molecular alignment.

Apart from these fundamental studies, Prof. Madhusudana has also been closely associated with the collaborative effort of the Raman Research Institute and Bharat Electronics (BE) to develop an indigenous knowhow for the manufacture of liquid crystal displays, which are now being marketed by BE. He also initiated the development of some new addressing techniques to multiplex matrix displays.

Prof. Madhusudana took his B.Sc. (1962), M.Sc. (1964) and Ph.D. (1971) degrees from the University of Mysore. He has taught under-graduates in Sarada Vilas College, Mysore, during 1964-65, and post-graduates in the University of Mysore in 1971. He has been pursuing his research activities in the Raman Research Institute, Bangalore, since September 1971, and is now a Professor. He was a visiting scientist at Laboratoire de Physique des Solides, Université Paris-Sud, Orsay, France, during 1983-84 and a visiting associate professor at the Centre de Recherche Paul Pascal, Université de Bordeaux I, France, for a few months during 1984-85. He is a Fellow of the Indian Academy of Sciences. He has over 90 publications to his credit and has been an invited speaker in several international conferences. □

### **Structural Ceramics for Launch Vehicles & Satellites — Paper presented by Dr B.K. Sarkar at ISAC-90**

Dr B.K. Sarkar, Director, Central Glass & Ceramic Research Institute (CGCRI), Calcutta, presented a paper entitled 'Structural Ceramics for Launch Vehicles & Satellites' at the International Symposium on Advanced Ceramics (ISAC-90) organized during 26-28 November 1990 at the Bhabha Atomic Research Centre, Bombay, which dealt critically the underlying aspects for the choice of structural ceramics in launch vehicles and satellites. It identified, area-wise, the applications of ceramics, and described research areas where improvement of performance would be essential to meet the sophisticated demands of manned space missions in future.

In the past few decades, space industry has been one of the major driving forces for the development



Dr B.K. Sarkar, Director, CGCRI, presenting his paper on Structural Ceramics for Launch Vehicles and Satellites, at ISAC- 90

of advanced critic materials. 'Weight saving' and correlated 'cost saving' are the keywords that stimulated the development and utility of ceramics as a structural material. Weight saving has been the primary factor for the selection of material for launch vehicles and satellites.

Ceramic materials exhibit a combination of very useful physical and mechanical properties along with high refractoriness, resistance to corrosion and erosion, and low evaporation loss in high vacuum. However, their application has been restricted owing to brittle behaviour and low toughness to withstand severe shock and vibration that a launch vehicle encounters during lift off. Yet they have been widely accepted in the form of fibres and composites. □

### **DBT-sponsored Training Course on Tissue Culture at CIMAP**

A 15-day DBT-sponsored training course on 'Protoplast Culture, Somatic Hybridization, Encapsulation and Genetic Transformation Techniques' was inaugurated at

the Central Institute of Medicinal and Aromatic Plants (CIMAP), Lucknow, by Dr P.V. Sane, Director, NBRI, Lucknow, on 19 November 1990 in which scientists of the local institutes and trainees drawn from various universities, institutes and industrial concerns from all over India, were present.

Welcoming the trainees and guests, Dr R.S. Thakur, Director, CIMAP, presented the salient achievements of Plant Tissue Culture Division of the Institute, such as development and release of a high yielding variety — BIO-13 of citronella Java, an important aromatic crop, and conservation of endangered medicinal plants through plant tissue culture. The laboratory has also embarked upon the programme for production of secondary metabolites in tropane alkaloid-yielding plants and ginseng which would enable the scientists to produce much needed raw materials in a short time, for pharmaceutical preparations.

Dr P.V. Sane, the chief guest, exhorted the scientists to adapt latest technologies of plant tissue culture for improving plantation crops, including medicinal and

aromatic plants. Dr Sane advised the tissue culturists to avoid overselling of their ideas before thorough verification of the results. He said that tissue culturists must work in collaboration with chemists, breeders, agronomists and plant pathologists in order to make their results more fruitful. Dr Sane was hopeful that the DBT training course would provide an excellent opportunity to the participants not only to learn advanced techniques of biotechnology but also enable them to exchange their views.

The training programme concluded on 5 December 1990. The function was presided over by Prof. C.P. Sharma, Head, Botany Department, Lucknow.

Prof. Sharma in his address praised the capabilities and R&D programme of plant tissue culture underway in CIMAP, ranging from micropropagation to protoplast culture, somatic hybridization, encapsulation and genetic transformations. He was hopeful that the participants would be applying these techniques in various crop improvement programmes.



Dr P.S. Ahuja, Head, Plant Tissue Culture Laboratory, CIMAP, briefing the audience about the aims and objectives of the DBT-sponsored Training Course. Seen on the dais (from left) are: Dr R.S. Thakur, Director, CIMAP and Dr P.V. Sane, Director, NBRI, Lucknow

Dr P.S. Ahuja, Head of the Plant Tissue Culture Laboratory, presented the vote of thanks. □

### **Training cum Demonstration Programmes on Ferrocement Technology in Karnataka**

As a part of the activities under Science & Technology Action Plan, the CSIR Polytechnology Transfer Centre, Bangalore, organized two two-day Training cum Demonstration Programmes on Ferrocement Technology at Bellary and Bidar during 19-20 and 22-23 November 1990 respectively. Shri P.C. Sharma and Shri Janardhan Swarup of the Structural Engineering Research Centre, Ghaziabad, gave lectures and actual demonstration on construction of ferrocement product.

The programme at Bellary was jointly organized with District Industries Centre, Bellary and Contractors & Builders Association, Bellary. The programme was attended by around 40 qualified professionals from PWD, Land Army, local engineering colleges and industry. The programme was inaugurated by the Chief Secretary.

The programme at Bidar was co-sponsored by the District Industries Centre and Karnataka State Financial Corporation, Bidar. Shri D.N. Narasimha Raju, Deputy Commissioner of Bidar, inaugurated and over 50 qualified professionals participated.

The state government organizations expressed their deep appreciation for the efforts made by PTC-Bangalore in bringing this technology to their door steps. □

### **CONFERENCE BRIEFS**

#### **Dr D.D. Haldar**

Dr Durga Das Haldar of the Central Fuel Research Institute, Dhanbad, attended the Eleventh International Coal Preparation Congress, from 22 to 25 October 1990 at Tokyo, Japan. Delegates from 23 countries participated in the congress and presented papers related to beneficiation of fine and ultrafine coals, process control and monitoring devices, development of dewatering systems, optimization studies and development of new equipment and techniques for coal beneficiation, etc. Dr Haldar presented a paper entitled 'Effect of Some Operating Variables on the

Adsorption of Conditioning Oil on Coal Particles' in the Innovations in Coal Cleaning Technology session.

#### **Dr Y.V. Ramana**

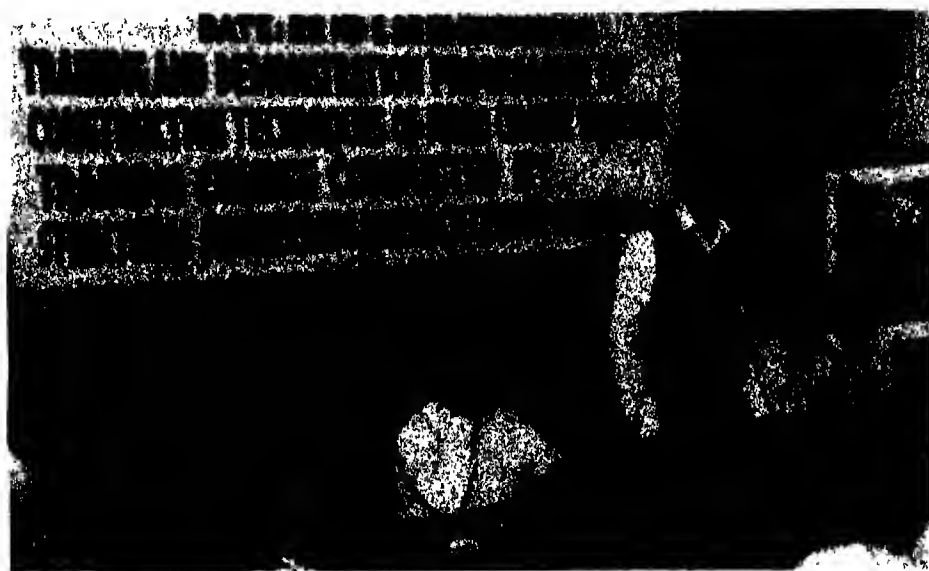
Dr Y.V. Ramana, Scientist, National Geophysical Research Institute (NGRI), Hyderabad, attended the fifth International Seminar and Exhibition on Earthquake Prognostics, held at Lagos, Nigeria, from 2 to 6 December 1990 and presented a paper entitled Sensing Microlevel Fluctuations in Groundwater by Pulse Echo Technique (PET) — A potential tool for earthquake prognostics.

#### **Dr D.D. Singh**

Dr D.D. Singh, Scientist, NGRI, Hyderabad, attended a workshop on 'Earthquake Sources and Regional Lithospheric Structures from Seismic Wave Data, held at Trieste, Italy, from 19 to 30 November 1990 and presented results of the seismological studies in the Indian region.

#### **Dr T.S.R. Prasada Rao**

Dr T.S.R. Prasada Rao, Director, IIP, Dehra Dun, delivered an invited talk on 'Design development and commercialization of zeolite-based catalyst for xylene isomerisation' at the International Workshop on Catalyst Design, held during 11-13 December 1990 at Trieste, Italy. The workshop was organized jointly by the Third World Academy of Science and International Centre for Pure & Applied Chemistry and was chaired by Prof. C.N.R. Rao, Director, Indian Institute of Science, Bangalore. Also, he had discussions on mutual cooperation with Prof. F. Trifiro of Department of Industrial Chemistry and Materials, during 14-15 December 1990 at Bologna, Italy. □



Shri D.N. Narasimha Raju, Deputy Commissioner, Bidar District, inaugurating the Training cum Demonstration Programme on Ferrocement Technology at Bidar

## **DEPUTATION BRIEFS**

### **Dr V. Yegnaraman**

Dr V. Yegnaraman, Scientist, Central Electrochemical Research Institute (CECRI), Karaikudi, was deputed to France under the exchange of scientists programme between the CSIR and CNRS, Paris, for a period of two months from 2 October 1990 to carry out investigations on joint research project on Electrocatalysis and Development of Biosensors.

### **Shri R.M. Sabarathinam**

Shri R.M. Sabarathinam, Scientist, CECRI, Karaikudi, visited Germany under the short term fellowship offered by the German Academic Exchange Service, for a period of three months from 1 October 1990. He got training in using modern techniques for the investigations of electrode processes such as electrochemical impedance spectroscopy, photo-electrochemical characterization of semiconductor electrodes, etc.

### **Shri S.K. Jain and Dr Alok Saxena**

Shri S.K. Jain, Engineer EI and Dr Alok Saxena, Engineer C, Indian Institute of Petroleum (IIP), Dehra Dun were deputed to the Institute Français Du Pétrole, France, during 23 July - 23 December 1990, to receive practical training for the latest design norms and techniques pertaining to petroleum refining processes. They also prepared the process packages for different international projects related to hydrosulphurization, reforming and hydrogenation processes.

### **Shri J.M. Nagpal**

Shri J.M. Nagpal, Scientist EI, IIP, Dehra Dun, visited Germany under

CSIR-DAAD exchange programme for two months from 2 September 1990 and worked on analysis of hydrocarbons and conversion of natural gas to liquid hydrocarbons through Fischer-Tropsch synthesis.

### **Shri S. Singhal**

Shri S Singhal, Scientist F, IIP, Dehra Dun, attended the First Asia-Pacific International Symposium on Combustion and Energy Utilization, from 15-18 October 1990 at Beijing, China. □

### **Dr Krishna Sapru visits CECRI under the TOKTEN Programme**

Dr (Smt) Krishna Sapru, Vice-President, Special Products, TIPS Inc., USA, visited the Central Electrochemical Research Institute (CECRI), Karaikudi, during 3-12 December 1990 as a UNDP expert under the Transfer of Knowledge Through Expatriate Nationals (TOKTEN) Programme. During her stay, she held discussions with scientists working in different areas of electrochemistry, especially with the Fuel Cells Group, on designing a prototype molten carbonate fuel cell system. □

## **TRAINING COURSES**

### **Integrated Training cum Demonstration Programme on Lowcost Building Materials & Housing**

Under the 35-Point Action Plan of Government of India, the programme on 'Lowcost Building Materials/Alternative Components and Related Construction Techniques' has been identified as one of the major thrust areas. In consonance with this, CSIR along with other related agencies

launched a massive effort to boost R&D work on lowcost building materials and disseminate the technologies developed. The Central Glass & Ceramic Research Institute (CGCRI), Calcutta, has long been engaged in the R&D activities on lowcost building materials/components with special emphasis on the use of available clay-based ceramic materials for this purpose, and dissemination of information on these activities.

As a part of these efforts, CGCRI arranged two training cum demonstration programmes. The first programme was on: Fibre Reinforced Plastic (FRP) Products as Lowcost Substitutes for Conventional Building Materials. Held during 27-30 August 1990, it was attended by about 35 participants from rural and urban sectors. The programme was sponsored by M/s CEAT Ltd (Glass Fibre Division) and M/s. Bakalite Hylam Ltd.

The second programme was on Lowcost Building Materials and was held during 5-15 November 1990. About 70 participants from all over the country, specially from the eastern and north-eastern regions, attended the programme. The technologies/materials covered in the programme were: Ceramic hollow blocks (glazed and unglazed), Tile-based slope and flat roofing elements, Lowcost concrete with water proofing, Hollow concrete blocks, Housing construction techniques using non-conventional building materials, and Low thermal mass (LTM) kiln for firing lowcost ceramic materials.

Most of the participants came to know for the first time about the lowcost building materials and the technologies developed at CGCRI to produce these. Some of the participants evinced interest to set up small scale units for production of hollow blocks. The civil engineers and architects felt satisfied about the utility of lowcost building



materials developed at CGCRI. The participants urged CGCRI to conduct more of such training cum demonstration programmes. □

### **Dr S.R. Gowarikar retires**

Dr S.R. Gowarikar, Director, Central Scientific Instruments Organisation, Chandigarh, has retired consequent upon attaining the age of superannuation. He handed over the charge to Dr J. Prasad, Scientist F, CSIO, on 31 January 1991 (A.N). □

## **HONOURS & AWARDS**

### **Dr G.P. Phondke awarded NCSTC National Award for Best Science & Technology Coverage in Mass Media**

Dr G.P. Phondke, Director, Publications & Information Directorate, New Delhi, has been awarded the NCSTC National Award for Best Science & Technology Coverage in Mass Media for 1991, jointly with Dr R. Sreedher, Director of Programmes (EB), All India Radio,

New Delhi. This award carries Rs 50,000 in cash, a bronze medal, and a scroll with a citation.

Dr Phondke is a popular science writer of repute. He has contributed more than 1000 articles on many science and technology themes in English, Marathi and Hindi. He has also written investigative articles on burning scientific and technological issues such as Bhopal gas tragedy, the imported Irish-butter controversy, the use of electronic voting machines, etc., and scripts for several radio programmes using diverse formats. He is author of 12 popular science books, including some on science fiction.

Dr Phondke was editor of *Science Today* during 1983-86 and served as the science editor of *The Economic Times* during 1986-89. A recipient of the Maharashtra State Award for Science Writing in Marathi for the year 1985-86, Dr Phondke has been Director of PID since June 1989.

Born on 22 April 1939, Dr Phondke did his M.Sc. in Nuclear Physics in 1960 from the University of Bombay. He was a physics

trainee at the BARC Training School during 1960-61. He obtained his Ph.D. degree in Biophysics from the University of London in 1967. He has served as a Professor at the Universities of Bombay, Poona and Baroda, besides serving as a Visiting Professor at a few foreign universities. He has published over 100 research papers, and six students have obtained Ph.D. degrees under his guidance. □

## **ANNOUNCEMENTS**

### **NISSAT-INSDOC Courses on Computer Application to Library & Information Activities**

The following seven short-term courses were organized under the joint auspices of the National Information System for Science and Technology (NISSAT) and the Indian National Scientific Documentation Centre (INSDOC), New Delhi: Computer Application to Library and Information Activities (four courses held on 18 Dec. 1989 to 12 Jan. 1990, 5 Feb. - 2 March 90, 2-27 April 1990 and 20 Aug. - 14 Sep. 1990), CDS/ISIS (Ver. 2.32) and Pascal (9 July - 3 Aug. 1990), Bibliometrics (22-28 Oct. 1990) and DBMS and dBASE III Plus (19 Nov. - 14 Dec. 1990).

The faculty for these courses was chiefly drawn from INSDOC with some experts from other organizations. Shri B.K. Sen, Deputy Head, Education & Training Division, acted as the course coordinator. In all, 114 participants attended these courses.

Eight short-term courses are planned to be held during 1991-92:

*Computer Application to Library & Information Activities* (for freshers; four courses): These courses will comprise MSDOS, CDS/ISIS, dBASE, Wordstar, Lotus 1-2-3 and theoretical classes on Microcomputer hardware, files



Dr G.P. Phondke receiving the NCSTC national award from Shri Mohan Dharia, Deputy Chairman, Planning Commission, at the National Science Day Celebrations on 28 February 1991



and database organization, computerized information retrieval, non communication format,

Duration of the course: Four/Five weeks [15 April - 10 May 1991 (seats booked), 19 Aug. - 20 Sep. 1991, 11 Nov. - 13 Dec. 1991, and 2 March - 4 April 1992].

**CDS/ISIS (Ver. 2.3) with PASCAL Interface** (for those having exposure to CDS/ISIS Ver. 1.0): The course comprises all the facets of CDS/ISIS (Ver. 2.3), programming through PASCAL and its application in the CDS/ISIS (Ver. 2.3) environment. Emphasis is provided on the creation of databases relating to various library & information activities and generation of computerized products like accession list, author index, subject index, library catalogue, directories of various kinds and so on.

Duration of the course: Four weeks (8 July - 2 Aug. 1991).

**Bibliometrics:** The course will cover definition, scope, limitations, mathematical bibliometrics; bibliometric laws; bibliometric tools; application of bibliometric methods for generating various indicators including science indicators; Indian contribution to bibliometrics; computerized searching of *Science Citation Index* in CD ROM. The last two days of the course will be devoted to presentation of papers by the participants and discussion of the bibliometric problems on which the participants are working.

Duration of the course: Two weeks (30 Sep. - 12 Oct. 1991).

**DBMS and dBASE:** The course will consist of both theoretical and practical classes and cover the following: Basics of database management systems, with examples of relational database management systems, dBASE III Plus and their library applications in acquisition, processing, circulation control and the salient features of dBASE IV.

Duration of the course: Four weeks (30 Dec. 1991 to 24 Jan. 1992).

**Recent Developments in Information Science & Technology** (refresher course for working librarians): The course will cover indexing, abstracting and thesaurus construction, technical writing, bibliographic formats, ISBD, ISO 2709, CCF & UNIMARC, bibliometrics & informetrics, computer application to library & information activities, computer communication networks, computerized databases and on-line searching, CD ROM databases & on-line searching, electronic mail, desktop publishing, reprographics, and teletex, videotex, etc. The course comprises lectures and demonstrations.

Duration of the course: Two weeks (4 - 14 Feb. 1992).

The number of participants for each of the above courses is limited to 15.

### **Associateship in Information Science**

In addition to the above short-term courses, INSDOC will hold the regular course on Associateship in Information Science for the 28th batch, starting from August 1991. Students for the course will be selected through written test and interview, to be held at several metropolis in India. Anybody having a second class Master's degree in any subject, or a four-year experience plus degree such as B.E. or MBBS, or post-graduate library science degree plus three years experience can apply. Forms and prospectus will be available from the first week of April 1991.

Further details regarding the courses can be had from: Shri B.K. Sen, Deputy Head, Education & Training Division, INSDOC, 14, Satsang Vihar Marg, New Delhi 110067.

### **Industry-oriented Technology Courses in Battery Technology**

The Central Electrochemical Research Institute (CECRI), Karaikudi, is organizing industry-oriented technology courses in battery technology during 1-26 April 1991.

The details of the courses are: Lead acid battery materials and components (1-5 April), Lead acid battery grid technology (8-12 April), Lead acid battery assembly and testing (15-20 April) and Lead acid battery — care and maintenance (22-26 April).

Further details regarding these courses can be had from: The Director, CECRI, Karaikudi 623006, Tamilnadu. □

### **PATENTS FILED**

625/DEL/90: An improved process for the separation of 1,4-benzoquinone, catechol, hydroquinone and phenol simultaneously, P.P. Moghe, A.S. Tambe, S.S. Biswas, A.V. Pol, M.G. Kotasthane, P.K. Bahirat — National Chemical Laboratory, Pune.

646/DEL/90: An improved process for the texturization of substrate surfaces, U.S. Tandon, B.D. Pant and W.S. Khokle — Central Electronics Engineering Research Institute, Pilani.

647/DEL/90: An improved process for the separation of 1,4-benzoquinone, phenol, catechol and hydroquinone simultaneously, P.P. Moghe, A.S. Tambe, S.S. Biswas, A.V. Pol, M.G. Kotasthane, P.K. Bahirat — National Chemical Laboratory, Pune.

648/DEL/90: An electronic device for disinfection of drinking water, P.K. Ray, V.K. Sehgal, H.O. Misra, S.P. Pathak, and S. Kumar — Industrial Toxicology Research Centre, Lucknow.

649/DEL/90: An improved process for the preparation of N-acetyl phosphoramidothioates, N. Borthakur, A. Goswami and R.C. Rastogi — Regional Research Laboratory, Jorhat.

961/DEL/90: A process for the preparation of a cathode for use in a magnesium metal oxide air cell, N. Muniyandi and K.I. Vasu — Central Electrochemical Research Institute, Karaikudi.

years may be highlighted, and sent alongwith one set of reprints of research papers published during the 5-year period. Nominations signed by the sponsors should be sent marked 'confidential' to the Head, Human Resource Develop-

ment Group, Extramural Research, CSIR Complex Pusa, New Delhi 110012 by 1 April 1991. Regulations governing the prize and the proforma for nomination may be obtained from the above address. □

## फार्म 4/FORM IV

[नियम 8 देखिए/(See Rule 8)]

### NOMINATIONS INVITED

#### CSIR Young Scientist Awards for 1991

Nominations are invited by the Council of Scientific & Industrial Research for the CSIR Young Scientist Awards for 1991. The awards are to be given for notable and outstanding research contributions made primarily in India during the past five years. The age of nominee should not be more than 35 years as on 26 September 1990. Regularly employed scientists working in CSIR system are eligible for consideration.

The awards each of the value of Rs 10,000, are given annually for contributions of applied or fundamental nature, in the following disciplines (1) biological sciences, (2) chemical sciences, (3) earth, atmosphere, ocean and planetary sciences, (4) engineering sciences and (5) physical sciences (including instrumentation).

Those who can make nominations are the directors/director level scientists/chairmen of various Research Councils of CSIR laboratories/institutes.

Nominations should be sent as per the prescribed proforma (20 copies) by registered post giving statement of work and attainments of each nominee. The attainments of the nominee during the past five

1. प्रकाशन स्थान/Place of publication
2. प्रकाशन अवधि/Periodicity of its publication
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(यदि विदेशी है तो मूल देश)/(If foreigner, state the country of origin)  
पता/Address

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Semi-monthly  
Dr G P Phondke  
Yes

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पता/Address

Publications & Information Directorate, Hillside Road, New Delhi 110 012  
Dr G P Phondke  
Yes

5. संपादक का नाम/Editor's Name  
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पता/Address

As above in (3)  
Dr B.C. Kashyap  
Yes

6. उन व्यक्तियों के नाम व पते जो समाचार-पत्र के स्वामी हो तथा जो समस्त पूंजी के एक प्रतिशत से अधिक के मालिकदार या हिस्सेदार हो।  
Names and addresses of individuals who own the newspaper and partners or share holders holding more than one per cent of the total capital.

As above in (3)

मैं, \_\_\_\_\_, एतद्द्वारा घोषित करता हूँ कि मेरी अधिकतम जानकारी एवं विश्वास के अनुसार ऊपर दिए गए विवरण सत्य है।

I, Dr. G. P. Phondke hereby declare that the particulars given above are true to the best of my knowledge and belief.

ता०/Dated 15 March 1991

Sd/- G P Phondke  
प्रकाशक के हस्ताक्षर/Signature of Publisher

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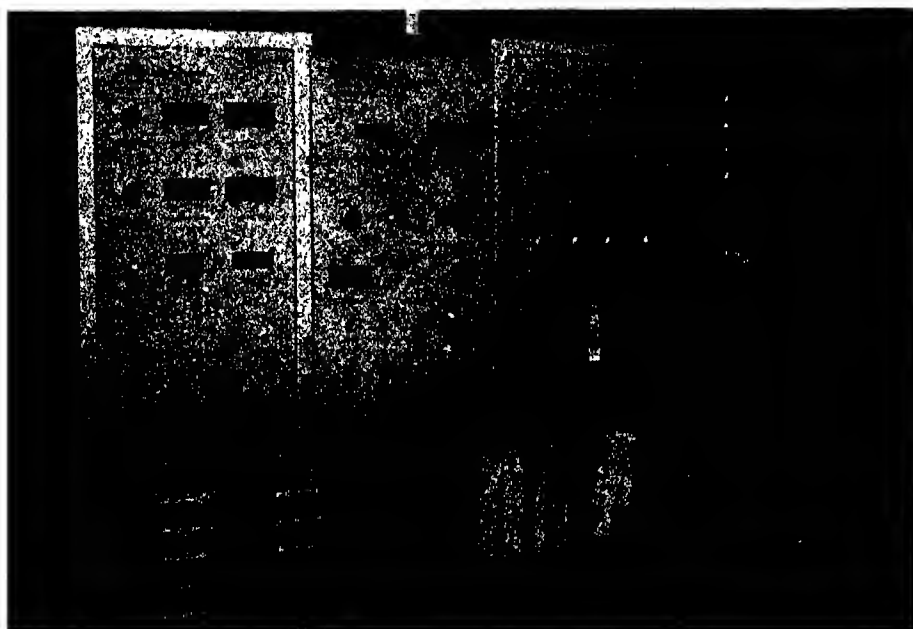
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# CSIR NEWS



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## IN THIS ISSUE

Prime Minister lauds CSIR Scientists	63
First Batch of Reference Materials released	65
Flexible Graphite—An Alternative to Asbestos	66
RRL-Jammu develops Technique for Somatic Embryogenesis and Organogenesis in Saffron	68
Satellite-borne Microwave Remote Sensing of Earth's Atmosphere and Oceans —Dr P.C. Pandey's	68
Bhatnagar Prize-winning work	68
CFTRI Monograph on Papaya	69
Indian Science Citation Index	70
Intensive Course on Free and Moving Boundary Problems	70
Dr R.S. Kapil gets Ranbaxy Research Award: 1989	70
Dr L.V. Venkataraman gets Prof. Vyas Memorial Award: 1990	71

Maintenance-free lead acid battery under automatic testing (top) and TSIA membrane cell at CECRI, Karalkudi. A report on the Institute's R&D activities for 1989-90 appears on p.62

# CENTRAL ELECTROCHEMICAL RESEARCH INSTITUTE, KARAİKUDI

## R&D Highlights: 1989-90

The R&D activities of the Central Electrochemical Research Institute (CECRI), Karaikudi, during 1989-90, were directed towards the following CSIR/Laboratory Thrust Programmes:

**A. CSIR Thrust Programmes —** The laboratory's activities under this group were related to the following areas: New materials, Catalysis science and engineering, Corrosion, and Polymer science and technology.

**B. Laboratory Thrust Programmes —** These programmes covered: Processes for electrolytic chemicals, Production of Electrolytic metals by hydro/pyrometallurgical technique, Batteries and fuel cells, Industrial metal finishing and Electrochemistry in biotechnology.

A brief account of the activities under the above programmes is presented here:

Work was pursued on the development of phosphor materials for application in lamps and TV screens. With a view to developing a high efficiency green component for lamps, a number of samples employing  $Tb^{3+}$  as activator in alkaline rare earth phosphosilicates having apatite structure were prepared and tested. Lanthanum orthophosphate with  $Ce^{3+}/Bi^{3+}$  appeared to be a promising material as a green component.

In an attempt to find an alternative to  $LaPO_4:Ce^{3+}, Tb^{3+}$ , which is expensive, alkaline aluminates system was found to be more suitable for use in trichromatic lamp systems. Preparative parameters were optimized for the  $SrO_2 \cdot Al_2O_3:Eu^{2+}$  system of phosphors. The process for the preparation of the blue light emitting silver activated ZnS phosphor was standardized on bench scale.

Supported by the Department of Electronics, studies were being

carried out on the development of CTV phosphors. Work on the development of photostimulated phosphors for computer radiographic imaging was carried out at the instance of DST. Sample phosphors such as  $Eu^{2+}$  activated barium halofluorides were prepared and preparative parameters optimised.

Conditions were optimised for deposition of  $Cd_{1-x}Zn_xS$  by electrochemical technique, for preparing (CdZn)S thin films.

In a study on the photoconductivity and PEC behaviour of CdSe films, good photoconductivity was observed in CdSe layers electrodeposited on  $SnO_2$  and ITO



Voltage scan generator and bipolar pulse generator



Prototypes of magnesium organic batteries

substrates and heat-sensitized at 600°C after copper incorporation.

The CECRI process for making ion-selective electrodes for  $\text{Br}^-$ ,  $\text{I}^-$ ,  $\text{CN}^-$ ,  $\text{Hg}^{2+}$  and  $\text{Pb}^{2+}$  was demonstrated and handed over to M/s Ceramic Systems, Madras. Work was continuing on the development of  $\text{K}^+$  and  $\text{Cd}^{2+}$ -selective electrodes, and sensors for glucose, ethanol and certain amino acids.

An optimum potential range of cathodic protection of steel in concrete was determined using hull cell model studies with IR compensation technique. The steel wire kept in the patented inhibitor solution was found to be free of rust even after 15 months. An adherent coating formed on the surface was found to impart increased corrosion resistance towards chloride attack.

Corrosion studies relating to precast spliced piles were undertaken for DST. Laboratory studies on corrosion of steel in deaerated chloride solution with hydrogen sulphide were carried out. Performance of a variety of protective coatings was tested under the same test conditions and inhibited cement slurry coating was identified as the top performer. The effect of impact blows on the corrosion of rebars was studied. The resistivity studies on concrete showed that impact blows increased the porosity. Using chemical resistance tests and salt-spray tests, the cement slurry and powder epoxy systems were evaluated. On evaluation of 113 protective systems, four cost-effective systems were identified. Field studies were in progress.

A project on assessment of biological and chemical characteristics of Kudankulam waters, east coast of India, was taken up for the Nuclear Power Corporation, Bombay. Samples of sea water, plankton, sea weeds, bivalves and bacteria were collected and charac-

## Prime Minister lauds CSIR Scientists

Lauding the work done by the CSIR scientists, Prime Minister Shri Chandra Shekhar stressed the need for taking research from the laboratory into the field. He was presiding over the Annual Meeting of the CSIR Society held on 6 March 1991, in New Delhi. Shri Chandra Shekhar, deplored the current policies wherein we look for easy collaboration from outside rather than adopting the brilliant researches of our scientists, for the industrial and economic development of our country. He stressed that a nation of India's size having complex problems cannot always depend on outside help to solve its problems. He emphasized that the genius of our scientists combined with the extensive manpower resources that we have would give this nation a great future.

Earlier, Dr A.P. Mitra, Director General, CSIR, briefed the Society members on the achievements of the Council in the last one year. He informed them that the external cash flow, which is expected to be Rs 1000 million

this year, is likely to go up to Rs 1500 million in the next couple of years. He also stated that around half the expenditure of CSIR is on R & D.

Prof. C.N.R. Rao opined that there is a large export market for science-based products and industries. CSIR must contribute to it by identifying a few key projects.

Prof. M.M. Sharma pointed out that there should be better interaction between the scientists and the industry, which would result in better flow of information through the consortia and other such agencies formed for the interaction of scientists and entrepreneurs.

Dr Mitra informed the members that CSIR had signed an MoU with UGC, as a result of which a permanent coordination committee under the Chairmanship of Prof. V.S. Bhide has been formed, which would identify the centres of excellence in research and exchange of scientists between CSIR labs and universities.

□

terized. Data on salinity, dissolved oxygen and temperature of the sites were recorded. Further studies were in progress.

Studies were being carried out at the instance of ONGC, Panvel, on pitting corrosion behaviour of steel welds in seawater, both in the laboratory and under actual exposure conditions in sea water at OPMEC, Tuticorin.

In a project, under Indo-US Programme on Accelerated Corrosion of Marine Alloys, atmospheric and immersion corrosion rates of aluminium (2S), monel, stainless steel (304), HSLA and titanium were measured in Tuticorin coastal waters. The fouling loads deposited on brass, cop-

per, aluminium, monel, HSLA and titanium were determined.

At the instance of ONGC, studies were carried out on the development of improved economic water treatment chemicals, and many types of inhibitors were synthesized and evaluated leading to a few successful formulations. Various compounds such as gluteraldehyde, cetyl pyridinium chloride, cetyl pyridinium bromide, zinc sulphate, formaldehyde and combinations of the above chemicals were tested as biocides. Effective economical compositions of biocides were determined.

M/s Salem Cooperative Sugar Mills Ltd, Mohanur, expressed the need for protective schemes for

various equipment and structures in sugar industries, as the organic coatings presently used were not giving adequate protection. Three types of paints were formulated, two based on epoxy and the third using chlorinated rubber. The painted panels were evaluated in sugar solution at different pH and temperatures. The epoxy-based paints gave adequate protection at all places, withstanding the temperature of 95-100°C and were recommended.

Suitable combination of phosphate coatings and paint schemes for maraging steel were recommended to the Aeronautical Development Agency, Bangalore.

Work on the development of luminescent paints was taken up at the instance of the Ministry of Surface Transport, for use on roads throughout the country. Various combinations of drying/non-drying alky resins with chlorinated rubber, nitrocellulose lacquer and acrylic resins were formulated with and without pigmentation. Also, a set-up for carrying out various tests on the paints developed was fabricated.

Synthetic methods for the preparation of conducting polyisoprene, polymethylphenylene and polytoluidine were worked out. Large scale preparation of polypyrrole, polythiophene, polyaniline and polytoluidine was carried out and newer catalyst-cocatalyst combinations were identified for quantitative yields of polymer formation.

A technique was developed to coat/impregnate insulating surface such as polyester films/polypropylene/glass wool/glass/synthetic cloth/cotton with conducting polymers such as polyaniline and polypyrrole.

For designing and developing a 100A electrochemical reactor for the reduction of maleic acid to succinic acid, studies were conducted in a 50A stirred-tank reactor, reus-

ing the electrolyte continuously. The yield of succinic acid was 80-85% and the energy consumption 2 to 2.5 kWh/kg. At the instance of a private party, the feasibility of reduction of maleic anhydride was studied and a product obtained conforming to AnalaR grade. The yield was 75 to 80% with an energy consumption of 2.8 to 3 kWh/kg.

TiO<sub>2</sub>/Ti electrode was prepared by thermal method, and used for the reduction of o-nitrophenol to o-aminophenol. Conditions like current density, temperature and acid concentration were optimised to get maximum yield. The electrode was also used for the reduction of 5-nitrosalicylic acid (5-NSA) to 5-aminosalicylic acid (5-ASA), an anti-TB drug, in 50% ethanolic solution containing 10% H<sub>2</sub>SO<sub>4</sub>, using lead anode; a good yield of 5-ASA was obtained.

A project on development of solid polymer electrolyte cells for chlor-alkali was taken up. Various undercoats were tried to enhance the life of TSA anodes. IrO<sub>2</sub>/Ta<sub>2</sub>O<sub>5</sub>-based coatings were found to be promising. Also, a new type of coating based on Co<sub>3</sub>O<sub>4</sub> was developed. Catalytic cathodes based on Ni/Pt-Ru were developed, which exhibited a hydrogen overvoltage of 70-80 mV in 30 wt% NaOH at 80-90°C and a current density of 3 kA/m<sup>2</sup>. Testing of these electrodes was planned to be carried out. Fabrication of components for a 6kA rating modified monopolar type membrane cell was in progress. The operation of this cell would be demonstrated to the Engineers of M/s Dhrangadhra Chemical Works, who are interested in setting up a 10 tonnes/day membrane cell plant based on CECRI technology.

A critical performance report on a 30kA cell, setup at the Titanium Facility of DMRL, Hyderabad, was prepared at their request and sent to them. Some

minor modifications for future trial runs were also suggested.

Assistance was rendered to M/s Tamil Nadu Magnesium and Marine Chemicals Ltd, Valinokkam, to help them start two electrolytic cells for the production of magnesium.

A 200A electrorefining cell for aluminium, based on the nonalloying refining technique, was constructed and operated. The extent of refining and the life of pillar support for refractory partitions were studied. To study the extraction of aluminium from Al-Si alloy through electrorefining (as an alternative to production of Al through Bayer-Hall-Heroult's route), a sinking type of refining cell was designed and constructed. After making further studies, attempts would be made to scale up the cell to 1000-2000A capacity.

At the instance of MALCO/NRDC, a procedure was worked out for the recovery of gallium values from the acid wash solutions generated during the initial purification of gallium. Also, exploratory work was carried out on the possibility of gallium recovery from the firm's alumina plant at Damajodi.

Work on the development of Ni-Fe battery was taken up at the instance of the Ministry of Defence. A prototype of Ni-Fe cell (1.37V, 60AH) was assembled with scaled up negatives and positives. The prototype was found to perform well while testing for cycling; energy efficiency was about 80%. Its charge retention was 50 to 60% of the nominal capacity at 0°C. However, work would be carried out to improve the performance of the cell to suit the requirements of the Defence.

In another project supported by the Ministry of Defence, for the development of maintenance-free lead-acid batteries, work was carried out to produce a prototype 12V, 90AH main-



tenance-free battery. Studies were carried out on lead-antimony-cadmium alloy and lead-calcium alloy. Ten cells were assembled with gel-electrolyte and evaluated. Studies on gas evolution were also carried out.

Under a project on development of Al-air batteries, supported by the Department of Mines, Ministry of Steel and Mines, work was carried out on the development of 3 types of electrolytes for the battery, namely alkaline citrate electrolyte, alkaline citrate cum stannate electrolyte and alkaline zincate electrolyte. A number of alloys were cast and characterized to choose the best material for the anode. The porous carbon cathodes were found to be incompatible with the best of aluminium alloy anodes and the above three electrolytes. Aluminium-air cells were constructed with superpurity aluminium-based anodes and carbon cathodes. On tests, they gave results comparable to zinc-air cells for the prescribed duration.

At the instance of Ministry of Defence, the development of Mg organic reserve battery to charge 1kWh secondary battery at  $-40^{\circ}\text{C}$  at high altitudes and remote places was taken up. Two 3V, 200AH batteries were assembled and discharged at room temperature at 4A current drain. The conductivity studies of Mg perchlorate electrolyte showed that suitable concentration and composition of the electrolyte gives better low-temperature performance. Studies were being made to improve low-temperature performance by proper insulation and suitable designing of the container.

Studies were also being made on Ni-Cd, Ni-Zn and Na-S battery systems and Li-MnO<sub>2</sub> and LiFe S button cells.

At the instance of Liquid Propulsion Systems Centre, Trivandrum, studies were carried out on electroforming of copper and

nickel for use as combustion chamber on a small mandrel. Six members of aluminium mandrels of size 150mm length and 30mm diameter were machined to the required dimensions and zincated. The specimens were electroformed with copper and channel cut. They were waxed on the group portions and metallized using electroless metal bath. Metallized chambers were nickel electroformed to the required thickness. The products were found to be satisfactory by the sponsors.

A project was taken up on anodizing and electrolytic colouring of 6063 Al extrusions for architectural applications. Conditions were standardized for electrolytic colouring in a 30 litre bath. Black colour could be achieved consistently over one foot extrusion length in nickel colouring bath. The samples were sent to the interested parties for consumer acceptability.

In an effort to modify the surface, PTFE coatings on aluminium, mild steel and stainless steel were developed for various applications. The aluminium surface was prepared by various methods to get amenable surface for coating PTFE. Tests as per IS specifications showed that the bonding was perfect.

Electroless deposition of metals, alloys and composite coatings are meant for wear and corrosion resistance and for magnetic applications. Electroless nickel plated samples were prepared and their properties studied. It was found that electroless nickel coating of high phosphorus content has better corrosion resistance value.

A suitable formulation was developed for production of green chromate film on bright zinc deposits. The know-how was offered to a leading automobile ancillary manufacturer. □

## First Batch of Reference Materials released

Certified reference materials are extensively used in industrialized societies for calibration of major analytical equipment without moving them out of the user's premises, validation of experimental techniques for analysis and quality assurance programmes. These materials have certified values of either a characteristic like composition, purity, structure and defects or a property like conductivity and viscosity. For assigning a quantitative value to any of the selected parameters, measurements are made at several laboratories with high quality facilities and expertise. At present, this activity is a part of a CSIR thrust area project 'Standardization, Metrology and Quality System'. Several other CSIR laboratories and some institutions outside CSIR with high quality expertise are also participating in this

programme. The National Physical Laboratory (NPL), New Delhi, is the coordinating laboratory. These materials have been christened as 'Indian Reference Materials'.

At a function organized at NPL on 21 January 1991, Dr A.P. Mitra, Director General, CSIR, released the first batch of the following three Indian reference materials: (1) Solution of lead in acidified high-purity water (concentration 1 ppm) (BND No. 101); (2) Solution of lead in acidified high-purity water (concentration 2 ppm) (BND No. 102), and (3) Solution of cadmium in acidified high purity water (concentration 1 ppm) (BND No. 201).

The first batch of solutions released by Dr Mitra was prepared in acidified water. The high purity water and nitric acid were prepared by sub-boiling distillation method. The measurements were made by



Dr A P Mitra releasing the first batch of reference materials

atomic absorption spectrometers and inductively coupled emission/mass spectrometers. Containers for these solutions have been selected after careful experimentation. The stability of these solutions has been experimentally found to be at least one year. These may be further diluted up to 10 times in one step. The dilution has to be carried out only with high purity water and nitric acid.

These Indian reference materials are available with NPL. The cost of these solutions is Rs 200 for each bottle of 50 ml. Laboratories engaged in environmental pollution studies and analysis of toxic metals at 1 ppm level or so will find these reference solutions useful.

Speaking on the occasion, Dr S.K. Joshi, Director, NPL, expressed satisfaction that a concrete output has emerged out of the CSIR thrust area project 'Standardization, Metrology and Quality System' and congratulated Dr Krishan Lal and the team of scientists engaged in this work. Dr Mitra, in his address, stressed the role of standard reference materials in modern quality assurance system. He mentioned that discussion on preparation of certified materials at national level

has been going on for a long time. He was happy that three reference materials were prepared by the CSIR laboratories together with a laboratory of industrial sector. He congratulated Dr Krishan Lal and his team for a well thoughtout programme and hoped that this contribution will have strong impact on the quality of data in the very important area of environmental pollution.

Dr Krishan Lal presented a status report and the plan in this area. It is proposed to prepare Indian reference materials based on water with all toxic metals, high purity acids, standards for X-ray diffraction and electron microscopy. Scientists from NEERI and NGRI were present on the occasion. Dr P.G. Gupta gave a vote of thanks. □

### **Flexible Graphite — An Alternative to Asbestos**

In a rapidly changing technological environment, asbestos fibre, which so far has been the most popularly used sealing material for use both in modern high performance engines (second generation) and for industrial applications such as faces of flat and spirally-wound gaskets and gland packings for

high temperature and corrosive environment, has now shown certain limitations. Also, the direct relationship found between exposure to asbestos dust and certain malignant tumours has proved asbestos to be a health hazard. As a result, many industries using asbestos products are now increasingly looking for alternative materials.

In view of this, the mining as well as the use of this material has already been banned in the developed countries. In India too, there is a distinct move by industry to acquire technology for non-asbestos alternatives. One important alternative to asbestos material is 'flexible graphite'. This material has superior qualities when compared to asbestos in many respects; especially the temperature resistance, chemical neutrality, sealability and hot-setting properties.

Flexible graphite is a binderless product prepared basically from exfoliated graphite which may be of synthetic or natural origin. Exfoliation of graphite is a process in which graphite expands 200-300 times along the c-axis and as a result, a highly puffed up material possessing very low density is obtained. The compression of this exfoliated graphite particles gives a flexible sheet which is usually named as flexible graphite foil.

#### **General Characteristics of Flexible Graphite**

1. It is impermeable to gases and fluids and can be used from -200° to 500°C in the oxidizing atmosphere and up to 3000°C in the non-oxidizing atmosphere.
2. It is not wetted by molten glass, metals, etc.
3. It offers high anisotropy in electrical and thermal conductivities.
4. It exhibits excellent temperature shock resistance.
5. It does not age or creep.

6. It is self lubricating and can be easily cut and punched.

7. It is resistant to radiation doses of any magnitude occurring in nuclear power stations.

In addition to the chemical and physical characteristics, a very important property of flexible graphite is its leak-proof sealing under low turning torques.

### Application Segments

Because of the above properties, the flexible graphite finds applications: (i) as sealing material for gaskets and packings; (ii) as protective material in tubes and containers against corrosive and hot gases; (iii) as lining for crucibles and casting moulds, (iv) as a release agent in hot presses and moulds; (v) in heat shielding, (vi) as electrical contact and conductor material, and (vii) as electrode for high energy density battery.

The leak-tight and sealing property of flexible graphite has given it a leading-edge over other materials in many areas of application. Some of the applications which have indicated appreciably improved results include the following: high temperature valve packing, chemical gauge glasses; naval steam valves and high pressure boiler feed pumps.

Flexible graphite products are already in use in India. At present the material is imported and converted to gland packings, flange packings, tape, packing rings and mechanical seals. In addition, flexible graphite finished products are also imported into the country, as components in other equipment.

### NPL's Process

The National Physical Laboratory (NPL), New Delhi, has developed, on a laboratory scale, an indigenous process for manufacture of flexible graphite. This material is highly suited for the manufacture of gaskets and

sealing application products. The process requires low capital investment and the raw material can be obtained indigenously. The physical characteristics of the graphite foil developed at NPL are as follows:

Tensile strength	40-65 kg/cm <sup>2</sup>
Strain to failure	1.2 - 1.3%
Density	0.5 - 1.3 g/cc
Compressibility	18% at 70 kg/cm <sup>2</sup> ; 45% at 350 kg/cm <sup>2</sup>
Recovery	50% at 70 kg/cm <sup>2</sup> ; 75% at 350 kg/cm <sup>2</sup>
Mean coefficient of thermal expansion :	(20-1000°C);
Parallel to the surface :	Nil
Perpendicular to the surface	50x10 <sup>-6</sup> /°C

The process know-how developed at NPL for the manufacture of flexible graphite sheets, tapes and seals has already been passed on to the following firms: M/s Rupindra Industries, New Delhi; M/s Jagjiwan Enchem Udyog Ltd, Ahmedabad, and M/s Stoplik Service (India) Pvt. Ltd, Bombay.

### Studies related to Structural Modification of $\beta$ -Boswellic Acid and related Triterpenoid Compounds

Phytochemical analysis of oleogum-resin of *Boswellia serrata*, which has already been established as an anti-inflammatory drug, was made by Shri D.S. Yadav of the Regional Research Laboratory (RRL), Jammu. The analysis resulted in the isolation and characterization of four major compounds, viz. acetyl boswellic acid, acetyl 11-keto- $\beta$ -boswellic acid,  $\beta$ -boswellic acid and 11-keto- $\beta$ -boswellic acid. Method for the estimation of the total acid contents of oleogum resin and its dif-

ferent extracts by non-aqueous titrimetric method, was standardized. Besides, X-ray crystallography studies of  $\beta$ -boswellic acid were also carried out to establish the complete structure and absolute configuration.

The investigations were mainly devoted to the preparation of analogues and study of their pharmacological properties, and establishing the structure and activity relationship. Several reactions were carried out which led to the synthesis of analogues, such as, methyl urs-12-en-24-oate (3,2,-c) pyrazole; methyl-11-oxours-12-en-24-oate (3,2,-c) pyrazole; 3-pyrazole of nor- $\beta$ -boswellic enone; 3-pyrazole of nor- $\beta$ -boswellenol; methyl 3 $\beta$ -acetoxyurs-24-oate (12,11-c) pyrazole; methyl-3 $\beta$ -hydroxyurs-12-en-24-oate; methyl 3 $\beta$ -hydroxy-11-oxours-12-en-24-oate; 3 $\beta$ -hydroxy-nor- $\beta$ -boswellenol; 3 $\beta$ -hydroxy-nor- $\beta$ -boswellenol; urs-12-en-3 $\beta$ -24-diol; 11-oxours-12-en-3 $\beta$ -24-diol; methyl-11-oxours-2,12-diene-24-oate. Fourteen anilide and amide analogues were also prepared. In total, about 50 analogues were synthesized. Some of these compounds showed enhancement in the anti-inflammatory activity in comparison to the parent compound.

Shri Yadav also carried out ORD/CD studies of  $\beta$ -boswellic acid and its various analogues. The ORD studies of acetyl  $\beta$ -boswellic acid and its synthetic analogues showed that the removal of carboxylic group, conversion of 3 $\lambda$ -hydroxy group to 3 $\beta$ -hydroxy group, introduction of double bond at position 2, introduction of 3-oxo, 11-oxo and 12-oxo functions in  $\beta$ -boswellic acid do not affect the sign of cotton effect of parent compound. They all exhibited positive cotton effect curves.

In case of CD spectra, all compounds exhibited positive cotton effect except for 11-oxo and 12-oxo

derivatives which showed negative cotton effect.

Shri Yadav carried out these studies under the supervision of Dr K.L. Dhar of RRL-Jammu and was awarded Ph.D. degree by the Jiwaji University, Gwalior. □

### **RRL-Jammu develops Technique for Somatic Embryogenesis and Organogenesis in Saffron**

Saffron (*Crocus sativus*, Family: Iridaceae) is an autumn flowering cormose plant, being cultivated since long in India in Kashmir valley and Kishtwar region of Jammu province. Commercial saffron (*kesar*) is dry stigmas of *C. sativus* which has been used medicinally and also as spice for colouring and flavouring foods.

The saffron plant is an infertile, autotriploid, which reproduces only vegetatively through corms. Owing to sterility, crop improvement through conventional plant breeding methods is difficult.

The scientists of Plant Tissue Culture Group of the Regional Research Laboratory (RRL), Jammu,

have succeeded in inducing somatic embryogenesis from yellowish, compact, nodular callus of saffron. The embryoids were found scattered all over callus with distinct yellowish embryogenic tissue. Embryoid formation was non-synchronous due to which embryoids of different stages, globular, heart shaped and torpedo

type were seen growing side by side. Torpedo type embryos were bipolar and whole structure resembled miniature plantlet. Somatic embryogenesis technique developed by RRL, Jammu will prove to be useful for: rapid multiplication of elite clones, inducing variability, and development of artificial seed technology in saffron.

### **Satellite-borne Microwave Remote Sensing of Earth's Atmosphere and Oceans**

**Dr P.C. Pandey's Bhatnagar Prize-winning Work\***

Dr P.C. Pandey has made significant original contributions in the interpretation of satellite-based remotely sensed data from both passive and active microwave sensors to study the earth's atmosphere and oceans. Some of these contributions are described below:

Dr Pandey helped India to initiate research and application of passive microwave radiometry, and develop the retrieval techniques. The physico-statistical technique

\*Dr P.C. Pandey, Space Applications Centre, Ahmedabad, has been awarded the 1989 Shanti Swarup Bhatnagar Prize in Earth, Atmosphere, Ocean & Planetary Sciences [CSIR News, 40(1990),220]



developed by Dr Pandey was applied to interpret SAMIR (Satellite

Somatic embryogenesis and organogenesis in saffron (*Crocus sativus* L.)

A = embryogenic callus, B = isolated somatic embryos showing different developmental stages, c = shoot differentiation from embryonic calli

Microwave Radiometer) data on-board India's first Remote Sensing Satellite, BHASKARA-I which was later followed by BHASKARA-II. Dr Pandey and his colleagues produced the first scientific results from SAMIR. The study demonstrated the usefulness of the data for mapping moisture over the vast data-sparse oceanic regions of the Bay of Bengal and the Arabian Sea.

The inclusion of 31 GHz radiometer in the BHASKARA-II mission was suggested by Dr Pandey, based on simulation results. He demonstrated quantitatively the advantages of including 31 GHz. The microwave emissivity model developed by him has been integrated with radiative transfer for simulation studies.

Dr Pandey developed advanced retrieval technique for interpreting data from Scanning Multichannel Microwave Radiometer onboard SEASAT satellite, launched by NASA, carrying the state-of-the-art microwave sensors dedicated to oceanic research. Several geophysical variables such as integrated precipitable water, sea surface temperature and wind speed were retrieved, validated and global maps generated depicting global features of circulation.

Dr Pandey's algorithm using Leaps and Bounds method was used for sensor optimization studies. He proposed different packages of channel combinations for tropospheric correction for TOPEX/POSEIDON mission, scheduled for launch in 1992. The radar altimeter onboard TOPEX mission will be an important component for the World Ocean Circulation Experiment (WOCE) and Tropical Ocean and Global Atmosphere (TOGA) programmes.

He developed a technique to retrieve temperature profile from Microwave Sounding Unit at 60 GHz, onboard TIROS-N satellite. He also performed simulation

studies for humidity profiling using Advanced Microwave Sounding Unit configuration proposed for next generation of operational satellites.

Dr Pandey and his colleagues developed algorithms to retrieve wind vector from scatterometer data. The technique has been extended to analyze forthcoming ERS-1 (scheduled for launch in May 1991) scatterometer data. Techniques have been developed to retrieve wind speed and significant wave height from altimeter data. Dr Pandey observed the important discrepancies in the global maps of wind speed, generated from inter-comparison of Seasat SMMR, altimeter and scatterometer sensor data. It has created a lot of interest among the scientific community and raised some fundamental questions regarding the sensing mechanism.

Dr Pandey has performed a very valuable study towards simulating the instrument data set for Microwave Limb Sounder onboard NASA's Upper Atmospheric Research Satellite (UARS). His work formed the basis for developing the algorithm and testing the production software. The UARS mission is dedicated to upper atmospheric research with special reference to the ozone depletion problem.

Dr Pandey has developed a novel method of combining microwave sensor data with infrared data to retrieve the cloud parameters needed for climate models.

Dr Pandey (born 10 August 1945) had his early education in Azamgarh, U.P. He obtained his Master's degree in Physics in 1966 and Ph.D. in Physics (Microwave Spectroscopy) in 1972 from the Allahabad University. He served as a lecturer at the D.A.V. Degree College, Azamgarh and as a research officer at the Central Water and Power Research Station, Pune,

before joining the Space Applications Centre (ISRO), Ahmedabad, in 1977. He worked as NRC/NASA Senior Resident Research Associate at the Jet Propulsion Laboratory, California Institute of Technology, USA, during 1981-83 and 1987-89. He received the NASA's certificate of recognition and cash award in 1985 and Hari Om Ashram Prerit Dr Vikram Sarabhai Research Award in Atmospheric Physics and Hydrology in 1987. He has 41 research papers and two patents to his credit. □

## NEW PUBLICATIONS

### CFTRI Monograph on Papaya

The Central Food Technological Research Institute (CFTRI), Mysore, has recently brought out an updated version of its monograph entitled, *Papaya in India - Production, Preservation, and Processing*. This publication contains latest information on such varied topics as cultural features, varietal characteristics, fruit chemistry, manufacture of papain, recovery of pectin and a host of new product possibilities. Modular project details for latex production and manufacture of 'lully-fruity' and fruit bars are some of the outstanding features. Trade information pertaining to suppliers of equipment and also the enzyme papain is also included.

For copies of the monograph, (price Rs 20 + VPP charges), please write to the Sales & Distribution Officer, CFTRI, Mysore 5700013. Other monographs available in the series are: (1) *Pineapple An Industrial Profile* (Rs 15), (2) *Pepper - A Profile* (Rs 15), (3) *Grapes in India* (Rs 20), (4) *Banana in India* (Rs 30), (5) *Mandarin Orange in India* (Rs 30), (6) *Mango in India* (Rs 50), (7) *Guava in India* (Rs 30).

## Indian Science Citation Index

In view of the very poor coverage of Indian S&T journals in the *Science Citation Index* (SCI) (In 1988, only 11 periodicals were covered out of some 700), it has been decided to generate an Indian Science Citation Database at the Indian National Scientific Documentation Centre (INSDOC), New Delhi, as part of the activities of the National Centre on Bibliometrics (a NISSAT- supported project).

Indian papers are mostly cited by Indian scientists. However, this particular citation picture does not get reflected in the citation scenario of S&T. As a result, in most cases, citation scenario of Indian papers, compiled on the basis of SCI remains incomplete. One of the major purposes of the *Indian Science Citation Index* is to provide a picture of the complete citation scenario of the papers of Indian origin. The software for generating the database has already been developed and tested. In fact, two softwares have been developed — one is UNIX-based and other one is MS-DOS based. In the earlier case, UNIFY package has been used and in the latter, CDS/ISIS (Ver. 2.3).

In the first phase, such research periodicals as are containing more than 80% research papers in their issues are being considered. This criterion ensures to cover all research periodicals being generated by major R&D organizations of the country, i.e. CSIR, ICMR, DRDO & ICAR and also by important research institutes like Indian Association for the Cultivation of Science, Indian National Science Academy and so on. The remaining periodicals will be covered in the later phase. The data inputting has already been started with the periodicals of 1990, and it is expected that by 30 June this year, more than 100 research periodicals will be covered.

Data base will generate, apart from the citation scenario of the papers of individual Indian scientists, source index, which will list the papers published in a year, subject index and affiliation index. It is intended to start to render services from this database from July 1991 onwards. □

## Intensive Course on Free and Moving Boundary Problems

The CSIR Centre for Mathematical Modelling and Computer Simulation (C-MMACS), Bangalore, organized an intensive course on Free and Moving Boundary Problems, during 3-7 December 1990. Forty-one participants (three from universities, 35 from CSIR laboratories and three from other R&D organizations), from varied disciplines, attended the course. The course was aimed at giving an introduction to the formulation and methods of solutions of free and moving boundary problems in various areas such as metallurgy, geophysics, hydrogeology, oceanography, and environmental pollution.

The course comprised a series of lectures by Dr R.N. Singh, NGRI (Co-ordinator); Prof. (Mrs) Renuka Ravindran, IISc; Prof. Phoolan Prasad, IISc; Prof. S.C. Gupta, IISc, Dr A. Maitra, NASA (USA); Dr K.S. Yajnik, C-MMACS and Dr M.I. James, C-MMACS. The lectures dealt with the formulation of models from first principles as well as the use of analytical, numerical and variational techniques in solving the free and moving boundary problems. □

## Honours & Awards

### Dr R.S. Kapil gets Ranbaxy Research Award: 1989

Dr R.S. Kapil, Director, Regional Research Laboratory

(RRL), Jammu, received the Ranbaxy Research Award in Pharmaceutical Sciences for 1989 from Shri Yashwant Sinha, Union Minister of Finance, at a function held in New Delhi on 28 January 1991. Instituted by the Ranbaxy Research Foundation, New Delhi, the award consists of a citation and cash amount of Rs 50,000 (shared by him with Prof. S.P. Gupta of BITS, Pilani).

This award has been given to Dr Kapil in recognition of his significant contributions to the field of drug development, both by synthesis as well as from natural



resources. Special mention can be made of his work on development of 7-methoxydeoxyvasicinone as a new anti-allergic agent, and also his work on anti-estrogens, which has opened a new area for the design of more potent, non-steroidal, non-estrogenic anti-fertility agents. Dr Kapil's investigations on drugs used in traditional systems of medicine has uncovered promising biological activity in a number of products. Some details of the award-winning work are given below:

#### (i) Anti-allergic agent

7-Methoxydeoxyvasicinone synthesized in 1973 at the Central Drug Research Institute (CDRI), Lucknow, has been found to be a



powerful orally active anti-allergic compound in mice and rats for which necessary permission from the Drug Controller of India, New Delhi, for Phase-1 clinical studies has been received. This work is being done in close collaboration with CDRI. Dr Kapil's group in Jammu is now engaged in the supply of this compound to CDRI in large quantity for testing purposes and also for development of a new and efficient method for its pilot scale synthesis.

LD<sub>50</sub> of this compound was found to be 1768.86 mg/kg i.p. and 2000 mg/kg p.o. in mice, and 1500 mg and >2000 mg respectively in rats. The compound when fed to rhesus monkeys (doses 12.5, 25 and 50 mg/kg body weight) for 90 consecutive days, did not produce any significant adverse effect on the body weight, haematology and blood chemistry. Gross and microscopic observations on the body organs and tissues did not reveal any abnormalities which could be designated as adverse effects.

## (2) Anti-implantation agent

Based on leads from earlier work done by CDRI, a new class of substituted 2H-1-benzopyrans was prepared, some of which were found to have only estrogen antagonistic activities and strong anti-estrogens binding 'site' (AEBS) affinities. A detailed SAR relationship in this class of compounds led to the selection of a compound (CDRI code No.85/287) for detailed biological evaluation.

This compound is a potent anti-implantation agent with very weak uterotrophic activity devoid of progestational, anti-progestational, androgenic, anti-androgenic and anti-gonadotropic activities. It is active (100%) in rats (2.5 mg/kg orally, 0.4 mg/kg i.p. in single day schedule) and inactive in hamster rats (25 mg/kg). General pharmacological screening has shown

that it has no other activity except being a mild stimulant.

At RRL-Jammu, Dr Kapil's group has further explored this lead for the synthesis of more effective compounds. While most of the compounds are more effective than the compound '85/287', the hydroxy/methoxy derivative has the maximum activity. It is 100% effective as an anti-implantation agent at 0.2 mg/kg dose in a single day schedule (once a month) in rats with weak uterotrophic activity. The LD<sub>50</sub> in rats is >4.0 gm/kg (orally), while other parameters remain same as for compound 85/287.

## (3) Immunomodulatory and anticomplementary activities

Compounds isolated from the fruits of *Aegle marmelos* have been found to stimulate the humoral and cell mediated immune responses, activate the peritoneal macrophages and possess an inhibitory activity in both classical and alternative pathway activation of human and guinea-pig complements. The fractions have been found to be virtually non-toxic orally.

## Dr L.V. Venkataraman of CFTRI gets Prof. Vyas Memorial Award: 1990

Dr L.V. Venkataraman, Area Coordinator, Autotrophic Cell Culture Discipline, Central Food Technological Research Institute (CFTRI), Mysore, has been awarded the Prof. Vyas Memorial Award of the Association of Microbiologists India for 1990. This is a prestigious award of the Association of Microbiologists India, given once in two years to an outstanding scientist for making significant contributions to any field of Microbiology. Dr Venkataraman has been selected for his contribution in developing the biotechnology for the production of alga *Spirulina* and its application in

health food and therapeutics. The award carries a cash prize and citation. The award was given during Annual Meeting and National Symposium of the Association held at the Tamil Nadu G.D. Naidu Agricultural University, Coimbatore, on 24 January 1991. □

## Dr R.N. Singh elected INSA Fellow

Dr R.N. Singh, Scientist, National Geophysical Research Institute, Hyderabad, and Associate, CSIR Centre of Mathematical Modelling and Computer Simulation, Bangalore, has been elected Fellow of the Indian National Science Academy (INSA), New Delhi, for his contribution to the field of Geophysics. He was earlier elected Fellow of the Indian Academy of Sciences, Bangalore, (1988). Dr Singh is a recipient of the Shanti Swarup Bhatnagar prize in Earth Sciences (1985).

Dr Singh is a Theoretical Geophysicist and has worked extensively in several disciplines aimed at gaining insight into the physico-chemical processes of the earth's interior and their surface manifestations through applications of mathematical modelling. Dr Singh's current research interest is in the study of non-linear/stochastic dynamics of the lithosphere. □

## RRL-Jammu Scientists get IDMA Research Award

The paper entitled 'Anti-inflammatory activity of Azepino-2, 1B-quinazolin-12(6H)-one-7,8,9,10-tetrahydro (RLX)' by G.B. Singh and Surjeet Singh of the Regional Research Laboratory (RRL), Jammu, and published in *Indian Drugs* Vol. 27(9), 449, has been selected for the Indian Drug Manufacturers Association (IDMA) Research Award in the discipline of Pharmacology. The award consists of a citation and a cash prize of Rs 1001. □

### **RRL-Jammu Scientists receive Best Paper Award at CSIR-DAAD Symposium**

The paper entitled 'Germplasm evaluation: Metroglyph and score index analysis of Indian and exotic germplasm collections of Celery (*Aptium graveolens* L.)' by Drs D.K. Choudhary and B.L. Kaul of the Regional Research Laboratory (RRL), Jammu, presented in the poster session at the CSIR-DAAD Symposium on Bio-Sciences (a follow-up seminar for the former DAAD fellows), held at the Central Drug Research Institute, Lucknow, during 15-18 November 1990, was adjudged as the best paper in the section of Agricultural Sciences. An award comprising certificate and a cash prize of DM 500 in the form of book grant was presented by the President of German Academic Exchange Service (DAAD), Bonn, Prof. Theodor Berchem, to the authors, at the concluding ceremony of the symposium held in the CDR, auditorium on 18 November 1990.

### **CSIR Complex, Palampur, Scientists win the Best Poster Presentation Award at IPQC**

A paper entitled 'Techniques for the production of virus tested carnation plants—A need for plant quarantine in international floriculture trade' by A.A. Zaidi, Raja Ram, S.N.H. Zaidi and D. Mukherjee of the Floriculture Division, CSIR Complex, Palampur (H.P.), got the best poster presentation award at the International Plant Quarantine Congress, held at Asean Plant Quarantine Centre and Training Institute, Kuala Lumpur, Malaysia, during 15-18 January 1991. The paper was presented by Shri S.N.H. Zaidi, who received the award.

### **Prof. K. Gopalan**

Prof. K. Gopalan, Scientist F, National Geophysical Research In-

stitute, Hyderabad, has been awarded the Medal of Honour with a citation for his meritorious contributions in the field of mass spectrometry, by the Indian Society for Mass Spectrometry during the Vth National Symposium on Mass Spectrometry held in January 1991. The award also carries a cash prize of Rs 2000. Dr Gopalan is a recipient of the prestigious Shanti Swarup Bhatnagar Prize. □

### **PATENTS FILED**

1014/DEL/90: Cycled potters wheel, B.K. Sarkar, S.K. Tarafdar and S. Banerjee — Central Glass & Ceramic Research Institute, Calcutta.

1015/DEL/90: An improved process for the preparation of conducting polypyrrole blends, S. Pitchumani and V. Krishnan — Central Electrochemical Research Institute, Karaikudi.

1016/DEL/90: An improved polymerisation process for the preparation of polyheterocycles blend, S. Pitchumani and V. Krishnan — Central Electrochemical Research Institute, Karaikudi.

1017/DEL/90: Improvements in or relating to synthesis of conducting polyanisidine, S.K. Dhawan and D.C. Trivedi — Central Electrochemical Research Institute, Karaikudi.

1018/DEL/90: An improved polymeric composition primarily based on polyvinyl chloride and nitrile rubber blends for synthetic soles with reduced plasticizer content and better performance characteristics, P. Rajalingam, G. Radhakrishnan and R.B. Mitra — Central Leather Research Institute, Madras.

1019/DEL/90: An improved process for the preparation of conducting polytoludine, S. Pitchumani and V.S. Krishnan — Central Electrochemical Research Institute, Karaikudi.

1020/DEL/90: A process for the

preparation of a polytoludine electrode and a cell using the said electrode, S. Pitchumani, V.S. Krishnan, R. Janakiraman, P.N.N. Namboodiri and R.I. Gangadharan — Central Electrochemical Research Institute, Karaikudi.

1021/DEL/90: An electronic device for time delay and low/high voltage protection of electrical/electronic equipment, J. Singh and D.L. Kapoor — Indian Institute of Petroleum, Dehra Dun.

1022/DEL/90: A process for the preparation of skin care lotion containing long chain fatty alcohols and esters of jojoba oil, P.J. Batukray, S.B. Dhanvantrai, R.M. Rajnikant and I.E.R. Rangaswamy — Central Salt & Marine Chemicals Research Institute, Bhavnagar. □

### **National Conference on Synthetic Membranes and Their Applications**

A two-day National Conference on 'Synthetic Membranes and Their Applications' will be organized by the Central Salt & Marine Chemicals Research Institute (CSMCRI), Bhavnagar, during 29-30 November 1991 at Bhavnagar. The congress will cover the following topics: development of polymers for use as membranes, membrane characterization, applications and membrane in water and effluent treatment, separation, concentration and purification processes in chemical industry and bio-technology, use of non-conventional energy sources and energy recovery systems, field experience on membrane-based desalination plants set up in rural and urban areas, etc. Although the conference is at national level the foreign participation is also welcome. For more details, interested participants may correspond with Dr A.V. Rao, Organizing Secretary, National Conference on Synthetic Membranes and their Applications, CSMCRI, Gijubhai Badheka Marg, Bhavnagar, 364002.

# CSIR NEWS



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Solar water heating system at NAL, Bangalore. The system has flat plate collectors with black chrome coating developed by the laboratory (p. 77)

## IN THIS ISSUE

International Symposium on  
Oceanography of the Indian  
Ocean 74

Polymers'91 — Symposium at NCL 75

Brain Storming Session on Electric  
Vehicles and Traction Batteries 75

Prime Minister lays Foundation  
Stone of Navodaya Vidyalaya  
at Ballia 77

Sensing Microlevel Fluctuations in  
Groundwater by Ultrasonics —  
A Potential Tool for Earthquake  
Prognostics 78

New Single-cylinder Sheet Forming  
Machine commissioned at  
RRL, Jammu 79

SERC-Ghaziabad Report 1986-90 79

CIMAP participates in Regional  
Science and Technology Fair  
at Jhansi 82

Prof B.R. Sant addresses FAPCCI  
Meeting on Technology  
Transfer 82

RRL-Jammu Training Programmes  
on Vocational Trades in Rural  
Areas 82

## International Symposium on Oceanography of the Indian Ocean

The National Institute of Oceanography (NIO), Goa, celebrated its silver jubilee from 13 to 16 January 1991. A function was held on 13 January; Dr A.P. Mitra, FRS, Director General, CSIR, was the Chief Guest and Dr S.Z. Qasim, Vice-Chancellor, Jamia Millia Islamia, presided. The staff of NIO who had completed 25 years of service were felicitated by Dr Mitra. He congratulated the NIO staff for achieving a distinction in the field of oceanography. A souvenir giving details of NIO's activities and achievements during the last 25 years was released by Dr Qasim. Dr B.N. Desai, Director, NIO, gave a brief narration of the development of oceanography in India. Dr Qasim, who was associated with NIO for a long time, went in retrospect on the development of the institute from the days of Indian participation in the International Indian Ocean Expedition which led to the establishment of NIO.

### The Symposium

The function of 13 January was followed by an International Symposium on Oceanography of the Indian Ocean (14-16 January) as a part of the celebrations.

The symposium was aimed at providing a forum to present and discuss the advances made in oceanography of the Indian Ocean and its adjacent seas, especially in the post-IIOE period. Since the symposium on Indian Ocean held in 1967, this was the first of its kind to discuss the whole spectrum of disciplines in oceanography of the Indian Ocean.

The symposium was inaugurated by Dr Mitra on 14 January 1991; Dr Qasim presided

over the inaugural function. Prof. E.C. LaFond (USA), a pioneer of Indian Oceanography was the Guest of Honour. Dr B.N. Desai, delivered a special talk on 'Indian Oceanography - An Overview.' In all, 155 papers were accepted for presentation, of which 134 papers dealing with Physical, Biological, Chemical and Geological Oceanography and Marine Instrumentation were presented and discussed during the three-day symposium. These included 30 papers from abroad. As many as 280 oceanographers from various organizations in the country and abroad participated in the symposium. Among them, 72 scientists were from Canada, France, UK, Germany, The Netherlands, USA, USSR and Caribbean.

Altogether, there were 18 technical sessions. Under the Biological Oceanography, topics covered were: microbial ecology and food

web dynamics, phytoplankton production—ecological and physiological processes, zooplankton—distribution and ecology, fisheries, coastal and deep sea ecosystems. Under Chemical Oceanography, the technical sessions were on biogeochemical cycles, marine pollution, large-scale ocean dynamics, and chemicals from marine organisms. Geochemistry and mineral resources, structure and tectonics, geomorphology and sedimentology and paleo-oceanography were the topics covered under Geological Oceanography. The technical sessions on Physical Oceanography and Instrumentation covered the topics such as large-scale physical processes, air-sea interactions, coastal processes, ocean technology and instrumentation.

The valedictory session of the symposium, held on 16 January, was chaired by Dr Desai. In this



Prof V K Gaur, Secretary, Department of Ocean Development, delivering the valedictory address on Indian Perspectives in Ocean Development

session, Prof. V.K. Gaur, Secretary to the Government of India, Department of Ocean Development, delivered the valedictory address on 'Indian Perspectives in Ocean Development'. Dr B.J. Zahurnec from Office of Naval Research, USA, made a presentation

on 'Indian Ocean—US Contributions'.

The abstracts of symposium papers have already been published and the proceedings of the symposium are expected to be published by September 1991. □

## Polymers'91 — Symposium at NCL

Polymers'91 was held at the National Chemical Laboratory (NCL), Pune, during 1-4 January 1991. First of its kind in over a decade, the symposium brought together distinguished scientists and technologists from industry, academia and research institutions. It covered diverse aspects of Polymer Science, namely, bio-related polymers, high performance polymers, polymer blends, alloys and composites, polymerization chemistry, structure and properties and synthesis and modification of polymers.

The symposium was inaugurated by Dr Vasant Gowarikar, Secretary, Department of Science and Technology, Prof.

M.M. Sharma, Director, University Department of Chemical Technology, Bombay, delivered the keynote address.

Dr Gowarikar in his inaugural address stressed the need for trained manpower in research in the polymer science area to meet the growing requirements of the Indian industry. He also touched upon the necessity to undertake research on polymers based on natural non-petroleum resources.

Prof. Sharma spoke on the pervasive nature of polymeric materials and the unique challenges that lie ahead of polymer scientists to meet the ever growing needs of organic materials for diverse end applications.

A total of 351 delegates attended the symposium, of which 39 were foreign delegates representing 12 countries including USA, USSR, Italy, Japan, France, UK, etc. Of the 312 Indian participants, 90 were from industry and the rest from academic institution including IITs, Defence, Space and CSIR institutions.

The technical sessions consisted of parallel oral sessions and a poster session. Eighty-six papers were presented in the oral sessions and 100 in the poster session. Sixty-four research students working for their doctoral degree in polymer science in various institutions in India presented posters. The oral sessions consisted of plenary, invited and contributed papers. Six plenary lectures were presented, of which three were by distinguished scientists from within India. Thirty invited lectures were also presented.

This year's Prof. M. Santappa Silver Jubilee Award in Polymer Science, sponsored by the Society for Polymer Science (India), was presented to Prof. A. Misra of IIT, Delhi, at a special function held on 2 January. The award ceremony was followed by the Award Lecture titled 'Incremental drawing a novel process for orientation of fibres'.

The proceedings of the symposium, consisting of 192 full papers, have been published in two volumes (pp 1068) by M/s. Tata McGraw-Hill, New Delhi. □



Dr Vasant Gowarikar, Secretary, Department of Science and Technology, inaugurating 'Polymers '91' at NCL, Pune

## Brain Storming Session on Electric Vehicles and Traction Batteries

The world is confronted today with two of the most serious crises — one is the oil crisis, both man-made and owing to fossil fuels depletion, and the other, pollution. No wonder that pollution-free environment and the oil crunch make electric vehicles operated by electrochemi-

cal power sources quite an attractive proposition. An additional advantage of the battery-powered vehicles is that they are noise-free and vibration-free and offer low maintenance cost. The Central Electrochemical Research Institute (CECRI), Karaikudi, has already done considerable amount of R&D work on a host of battery systems such as lead-acid battery, sodium-sulphur battery, nickel-cadmium battery, lithium battery, fuel cells, etc.

With a view to focus the urgency of the problem and need for a planned development of this programme as an inter-institutional and collaborative project, a Brain Storming Session on Electric Vehicles and Traction Batteries was organized by CECRI on 7 December 1990. The session was inaugurated by Dr Ram K. Iyengar, Additional Director General, CSIR; Prof. S.K. Rangarajan, Director, CECRI, presided

Prof. Rangarajan in his address gave an account of the advances made in the area of batteries at CECRI and said that the infrastructure and the research output in the area of batteries would get a boost under the UNDP

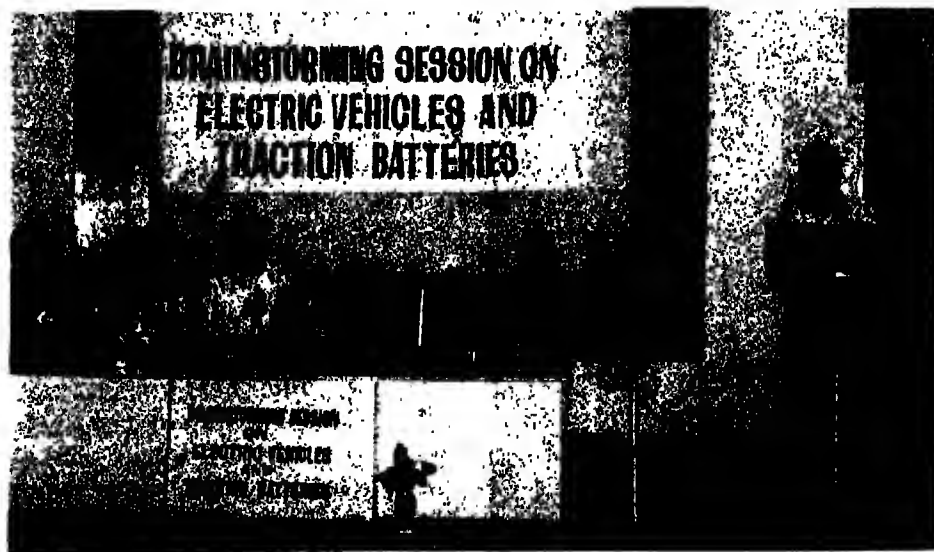
programme on testing and evaluation of batteries. The brain storming session, he said, was meant to evolve a national strategy for the development of electric vehicles taking into consideration the economic, social and cultural background. Stating that the stage is now set for the take off from the institute programme to national programme, he touched upon the silent revolution that is taking place in the field of batteries and electric vehicles. In this context, he pointed out that indiscriminate import of technology may harm the development of indigenous technology.

Dr Iyengar, in his inaugural address, explained some of the features that make electric vehicles very apt for the crowded metropolitan conditions. He remarked that a cruising speed of 30 km and a top speed of 50 km would be quite suitable for Indian conditions. He called upon for improvement in high energy density batteries such as lead-acid batteries and sodium-sulphur batteries. He said that there are two options available for the choice of batteries: (i) conventional batteries

and (ii) a modular system of batteries assisted by solar energy.

A number of experts from various organizations concerned with batteries and vehicle engineering, e.g. Bharat Heavy Electricals Ltd, Central Electronics Engineering Research Institute, Indian Railway Institute of Electrical Engineering (IRIEE), Vehicles Research and Development Establishment (VRDE), Standard Batteries, etc., participated in the session.

Shri K.C. Govil, Director, IRIEE, chaired the first session on batteries for electric vehicles (EVS). Dr N. Venkatakrishnan presented the lead-acid battery systems for EVS. Shri Shukla (BHEL) pointed out that BHEL had developed electric vans powered by lead-acid batteries, which are being used in Delhi. Prof. Rangarajan, explained the practical difficulties involved in achieving theoretical values based on thermodynamics and remarked that the realistic targets set for lead-acid battery systems should be about 35 Wh/kg under vehicle conditions. Dr Iyengar suggested that CECRI should play a pivotal role in developing the technology for lead-acid batteries of 35 Wh/kg and 200 life cycles. Shri Govil pointed out that the lead-acid batteries produced so far in the country are not meant for EVS and suggested that CECRI should develop the know-how for such batteries. Participating in the discussion, Shri V.R. Subramaniam said that lead-acid battery is going to be the main power source during the next decade. Shri C. Chakravarthy presented a paper on nickel-iron batteries indicating their special electrochemical characteristics suitable for EVS. Prototypes of nickel-iron batteries have an energy density of about 50 Wh/kg and a power density of 80-100 W/kg. It was reported that electric vehicles powered by nickel-iron batteries have a range of about



Dr Ram K. Iyengar, Additional Director General, CSIR, delivering the inaugural address at the Brain Storming Session on Electric Vehicles and Traction Batteries



200 km per charge at a speed of 40-50 km/h.

Dr M. Kamaludeen presented a paper on the development of sodium-sulphur battery at CECRI. Sodium-sulphur battery is a high energy and power density (120 Wh/kg, 180 W/kg) system which has been identified as one of the most promising batteries for EVS traction. It was pointed out that the availability of sodium and sulphur may not pose any problem as sodium is produced in tonnage quantities in the country using CECRI know-how. Dr Iyengar disclosed that facilities would be built up at CECRI for prototype development, before transfer to industry.

Dr V. Kapali in his paper gave an account of the development of aluminium-air battery at CECRI. The feasibility of using aluminium-air battery system in vehicles either alone or as a hybrid system in conjunction with lead-acid and nickel-iron systems was discussed. Dr Iyengar felt that aluminium-air battery system is also in the race with different types of batteries for EVS.

The two panels set up on the occasion to consider various proposals and future plans on the types of EVS and traction batteries, recommended for carrying out R&D work towards development of a passenger bus using AC motors and controllers, and of a small city car using state of the art materials and technologies to the extent possible. The battery-powered autorickshaw already developed by CECRI should be perfected and extensive field trials carried out. In the field of batteries, the panel recommended the development of lead-acid batteries for short term applications, nickel-iron batteries for short term applications and sodium-sulphur batteries for intermediate term applications.

In addition, it was also recommended that research work on aluminium-air, nickel-nickel

hydride and lithium battery systems should also be continued as

these are promising candidate batteries for electric vehicles. □

## Prime Minister lays Foundation Stone of Navodaya Vidyalaya at Ballia

Prime Minister, Shri Chandra Shekhar laid foundation stone of Navodaya Vidyalaya (NV) in Ballia (U.P.) on 1 February 1991. Shri Raj Mangal Pandey, Minister of Human Resource Development and Chairman of the Navodaya Vidyalaya Samiti, presided over the function, and Shri Bhagey Govardhan, Minister of State, Human Resource Development, welcomed the guests.

At the request of NV Samiti, a small exhibition was put up by the Central Building Research Institute (CBRI), Roorkee, which is the nodal agency for planning and designing of all NV complexes throughout the country. The ex-

hibits explained the designs prepared for different geo-climatic regions, and the cost-effectiveness of building technologies employed in the construction of NV complexes. The exhibits included posters and three-dimensional models of school building, dormitories, staff quarters, etc.

Shri V.K. Mathur, Project Coordinator, NV Project, explained the exhibits to the Prime Minister and other dignitaries. CBRI has finalized designs of about 200 sites, incorporating R&D technologies developed at the institute. The cost-effectiveness of technologies are expected to yield economy to the extent of 10-15%. □

## Black Chrome Coating for Solar Heaters

The National Aeronautical Laboratory (NAL), Bangalore, has installed at its premises a solar water heating system. The system has flat plate collector with selective black chrome coating, and is capable of heating water up to 80°C. (A selective coating is one which has high absorption and low emittance.)

Black chromium, an optical composite of chromium metal and chromium oxide, is perhaps the best available material for selective coating. But there is a problem with black chromium; it has to be produced by electrodeposition and the electroplating is not easy. First of all, the deposition has to be carried out at a temperature lower than 20° and secondly, the coating has to be carried out at current density three times of that required for chromium plating. These requirements make the process

much more expensive.

One important feature of the NAL black chrome coating is that it stays black even after prolonged exposure to the sun. Most of the other commercially available black coatings tend to lose some of their blackness after being exposed to the sun for 15-20 days. Electron spectroscopic studies carried out at NAL revealed that the non-NAL black chrome deposits contain carbon not only in the surface but also in the bulk of the deposit. Also, these deposits show presence of nickel oxide on the surface and sub-surface layers. The presence of the carbonaceous matter means that some of the additives added to the plating bath are of an organic nature. Nickel oxide probably gets formed owing to interaction between nickel, diffusing into the deposit from the substrate. Since NAL black chrome is free from carbon and does not contain nickel

oxide even in the layers well below the surface, the deposit is stable even on prolonged exposure to sun. As a consequence, the coating assures stable absorptivity and emissivity. It is expected that the coating will continue to serve for 10

years.

This NAL technology is available at a lumpsum premium of Rs. 50,000; there is no recurring royalty and the licence is non-exclusive. □

## Sensing Microlevel Fluctuations in Groundwater by Ultrasonics — A Potential Tool for Earthquake Prognostics

Measurement of fine water levels with a good degree of accuracy in the shortest time span possible for any part of the terrestrial environment is important to understand

and interpret the aquifer responses for different stresses in earth systems and hydrogeological programmes. The natural variations in the rates of water levels are

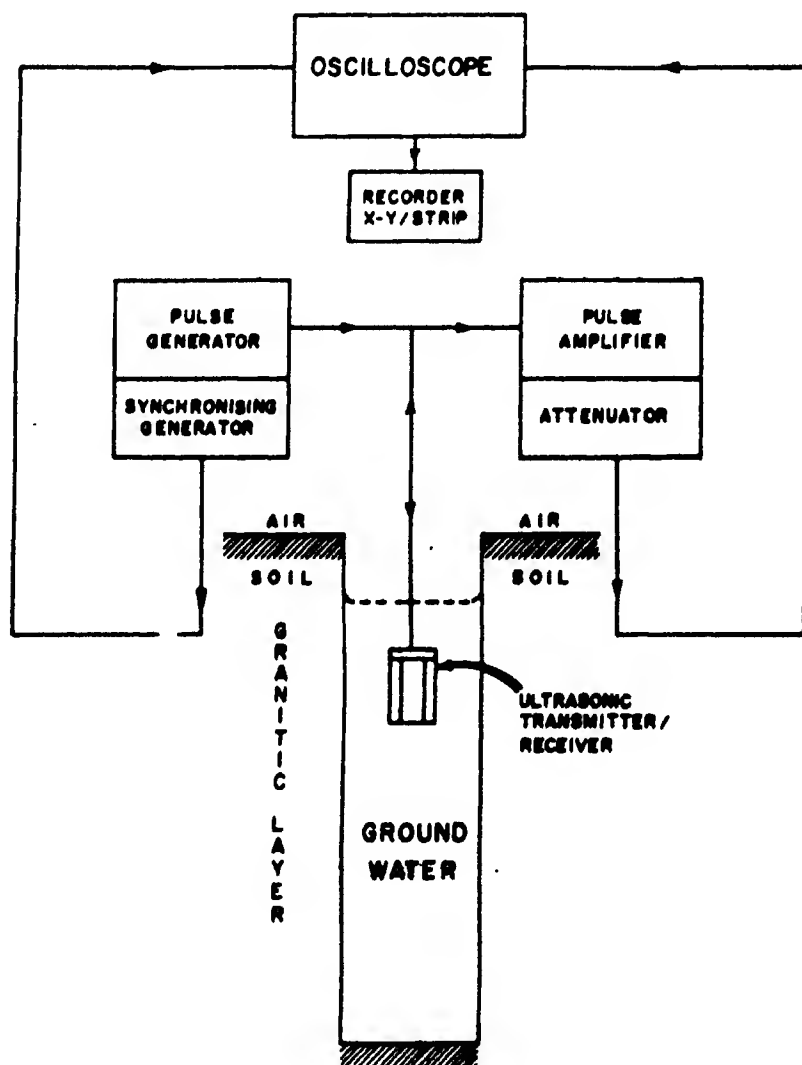
considered to be useful in ecological and geophysical studies. The study of fine microlevel changes in groundwater systems assumes special importance in earthquake prognosis, because sharp rise and fall of water levels are noticed in many earthquake prone regions, well in advance along with other precursory events.

For sensing instantaneously such fine microlevel changes in groundwater, a simple and convenient technique, known as the Pulse Echo Technique (PET), has been developed by Dr Y.V. Ramana and Dr I. Radhakrishna, Scientists of the National Geophysical Research Institute (NGRI), Hyderabad. The novelty and uniqueness of the technique lies in its sensitivity to detect fine changes in the water table to the extent of even a fraction of a mm, employing only one acoustic transducer for such detection. The experimental studies carried out at NGRI by these scientists have shown encouraging results.

The set-up of PET consists of an ultrasonic transducer being lowered to any desired depth in a borewell such that the active part of the transducer faces upwards. This transducer functions as the transmitter of the ultrasonic energy, as well as the receiver of the free surface reflected energy. A graduated non-corrosive tape attached to the transducer, ensures its placement in a flat and vertical position, below the water surface.

The system (acting as a fixed path echo generator) takes advantage of the echo patterns (resembling the field seismic wave forms) that develop between the two ends (the transmitting and reflecting).

The results obtained so far are optimistic and indicate that this technique (PET) could perhaps find a wider use to study and analyze the precursory coseismic events in an earthquake prone belt, in order



Schematic diagram of the pulse echo technique for sensing microlevel changes in ground water

to understand the problem of prognosis.

In view of the stimulating experiments, and encouraging

results, an Indian Patent has also been filed for PET as applicable to field hydrogeological conditions. □

### **New Single-Cylinder Sheet Forming Machine commissioned at RRL, Jammu**

A new single cylinder-sheet forming machine has recently been commissioned at the Regional Research Laboratory (RRL), Jammu. The machine has modified spider-less cylinder which gives better and uniform sheet. Even thinner sheets of paper can be obtained. The pulp is fed in a parallel current system. The machine is directly attached to a condux defibrator for pulp supply (directly pumped to the overhead stock chest). It has a provision to be connected to Hollander beaten pulp also. The machine occupies less space and gives better recovery and product.

The machine partly fabricated in RRL workshop will be used for the development work on paper and paper board from various agro

industrial cellulosic residues by the Cellulose Pulp Division of RRL-Jammu for the project on Integrated Utilization of Lignocellulosic Materials. It will also serve as a demonstration cum training unit. □

### **Studies on control of mosquito *Culex quinquefasciatus* by using natural products and biocides**

Shri U. Suryanarayana Murty, Scientist, Indian Institute of Chemical Technology (IICT), Hyderabad, studied the efficacy of the indigenous plant products and microbial biocides on the larvae of *Culex quinquefasciatus*, a principal vector for bancroftian filariasis, a

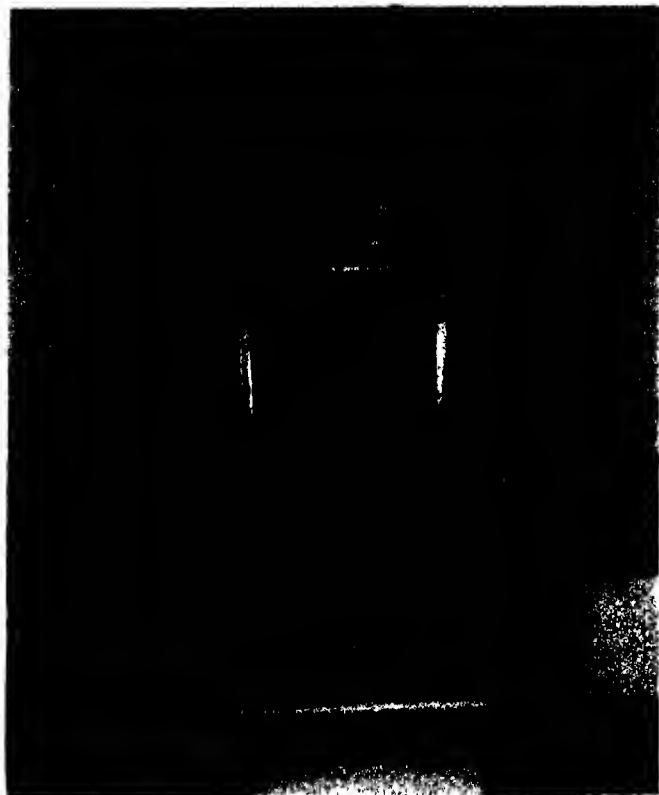
common non-fatal tropical disease. Larvae belonging to three habitats, i.e. cess pit, cement tank and 'U' drain were utilized for this investigation. The effect of the plant products on the nutritional status of the larvae was also analyzed and it was found that the plant extracts significantly interfere with the biochemical parameters in reducing the total proteins, lipids and sugars of the larvae. Two plant products, i.e. *Mundulea suberosa* (Family: Leguminosae) and *Eichhornea crassipes* (Family: Pontodereacea) were evaluated for their interference in wingbeat frequency of the flier. It was found that both the compounds affect the wingbeat frequency of the male flier only. The static parameters, dynamic parameters and aerodynamic parameters were also studied to understand the aerodynamics of the flier. The results revealed that the flier has higher aspect ratio due to which it can hover for a considerable period. This type of study explains the swarming behaviour of the flier in endemic areas. Two commercial microbial formulations, i.e. spore dust and saw dust of *Bacillus thuringiensis* and *B. sphaericus* were evaluated on the larvae, and the spore dust of *B. thuringiensis* was found to be more suitable for cess pit and cement tank type of habitats whereas *B. sphaericus* was found to be suitable for 'U' drain habitats.

Shri Suryanarayana Murty, carried out this investigation under the supervision of Dr (Smt) Kaiser Jamil of IICT, and was awarded Ph.D. degree by the Osmania University, Hyderabad. □

### **PROGRESS REPORTS**

#### **SERC-Ghaziabad Report: 1986-90**

The Structural Engineering Research Centre (SERC), which was



Single-cylinder sheet forming machine commissioned at RRL, Jammu

functioning from Roorkee, moved to its new premises at Ghaziabad; the process of shifting started in 1986 and continued till the end of 1988. However, the laboratory started functioning from the partially constructed building in 1987, concentrating its R&D efforts in the field of: Underground structures including tunnelling, High rise buildings, Development of computer software for civil engineering applications, Large span structures and Storage structures. The main-frame computing system was made operational at the new premises and most of the software was implemented, and high-powered analysis and design packages made available for use. The Model Analysis Laboratory and the Instrumentation Laboratory were substantially equipped. Considerable progress was achieved towards setting up of the Industrial Wind Tunnel.

The Archaeological Survey of India entrusted the Centre with structural engineering studies of Taj Mahal, aimed at long-term preservation of the monument. SERC initiated studies towards the analysis of the main dome for meridional and hoop stresses, as the curvature of the dome does not conform to any well-defined geometric shape. Also, investigations were taken up to study the stress condition in the massive main structure, both at first and second floor levels.

The importance of 'performance factors' such as corrosion of steel, degradation of concrete, susceptibility to dynamic effects, etc. is being increasingly recognized by bridge engineers. But data relating to these factors can only be obtained from the field, i.e. through instrumentation of actual bridges. The S&T Advisory Committee attached to the Ministry of Surface Transport (MOST) has accorded a very high priority to *in situ* investigations on bridges. SERC has

also decided to give instrumentation of bridges topmost priority. Under this programme, the Centre took up the performance measurements and monitoring through instrumentation of the Ganga Bridge at Varanasi. The proposed bridge would involve several major features such as the largest cantilever span, double cell box girder bridge deck (for the first time in India) erected by free cantilever technique. Performance measurements would be carried out on both the superstructure and the well foundation of the bridge, with a view to obtaining important information/data relating to its short-term and long-term behaviour. A number of performance parameters such as soil pressures, strains and stresses, tilts and shifts, deflections, slopes, etc. would be measured during the construction as well as a brief initial period of 2-3 years. Thereafter, the bridge would be monitored on a long-term basis. The structural scheme of the bridge was studied and the various parameters which call for *in situ* measurements and monitoring both in the superstructure and the well foundations of the bridge were decided upon after extensive discussions with MOST. Considerable effort was devoted to the selection of the most appropriate equipment from amongst the alternatives available worldwide. Procurement of equipment was in progress.

After the collapse of Mandovi bridge at Goa and in view of the fact that several other concrete highway bridges are severely distressed, MOST emphasized the need for monitoring the performance of major concrete bridges which are either under construction or distressed. In recognition of this need, the ministry sponsored a research scheme to get an indication of loss of prestress and the onset of corrosion in the new and recommissioned bridges across river Mandovi at Goa. As a follow-

up, a team of scientists of the Centre visited the bridge site and prepared a proposal of three-year duration to instrument the bridges and to monitor strains, deflections, slopes and dynamic characteristics through embedded/surface mounted vibrating wire gauges, tiltmeter, water level system, geodetic equipment, accelerometers, FFT analyzer, etc. The corrosion studies for the bridges are planned to be carried out by CECRI, Karaikudi.

The Department of Atomic Energy (DAE) requested SERC to undertake the instrumentation of Narora Atomic Power Project Containment Vessel-1 and assess its structural behaviour during pressure test. The objective of this sponsored project is to measure: radial displacement of the containment vessel at four azimuths, at five different elevations and vertical deflection at four points at EL 117.60; vertical movement of containment slab at several points; strains at junction of ICW and base raft, near the largest opening, junction of ICW and containment slab, and surface temperature at a few points. Deflections were measured using strain gauge type deflection transducers. Special type of brackets were fabricated at site to mount these transducers. These measurements were taken at 28 locations. Electrical strain gauges were used to measure strains at 32 locations. The containment vessel was tested to a maximum pressure of 1.44 kg/cm<sup>2</sup> and the deflections and strains were recorded using Peekle data acquisition system. A project report containing an analysis of the data and the recommendations/conclusions based thereon was submitted to DAE in June 1988.

The Roads Wing of MOST sponsored a research programme to develop computer software for the analysis and design of various simply supported superstructures

in reinforced and prestressed concrete with solid slab, T-beam and box girder type cross-sections for right, skew and curved crossings. The work has been split into modules and distributed among four institutions, viz. SERC, Indian Institute of Technology (Delhi), University of Roorkee and National Informatics Centre. SERC has been assigned the task of developing computer software for the following: Designing flexural steel, its curtailment and shear steel in reinforced concrete T-section; Designing longitudinal and transverse flexural steel and its curtailment in reinforced concrete right slab bridges; Designing steel for flexure and shear in prestressed concrete T-sections; and Checking of prestressed concrete T-section with given data.

The work pertaining to the following aspects of the project was completed: (1) R.C. T-beam bridge—Based on the IRC codal provisions and the design practice, input data requirement was identified. A detailed flow chart was prepared for the design and detailing of R.C. T-girder. Computer software was developed for the calculation of number, location, length and quantity of longitudinal reinforcement including bent up bars, shear stirrups and surface reinforcement. The software was being tested for practical cases given in the IRC handbook on T-beam bridges. (2) R.C. slab bridge—As in the case of R.C. T-beam bridge, a detailed flow chart was developed for the calculation of number, spacing, length and quantity of longitudinal reinforcement and transverse reinforcement at top and bottom. The software was tested for different spans given in the IRC handbook on R.C. slab bridges. (3) Prestressed concrete T-girder bridge—Formulation of mathematical expressions to calculate the geometrical properties of prestressed and composite T-gir-

der sections, and the prestressing steel in the longitudinal direction was completed and the corresponding computer program developed.

A large number of tall buildings in the country are located on alluvial soils, like the Indo-Gangetic plains. The behaviour of the building is substantially modified by its interaction with the supporting media which are themselves highly deformable. Multistoreyed buildings with individual column footings are particularly susceptible to such deformations. The techniques available for accounting for such an interaction are extremely cumbersome and expensive and, hence, rarely used in any design office. The Centre took up a project to study the soil structure interaction in tall buildings, with the objective of developing suitable techniques for the analysis of such buildings. The super structure, sub-structure and the supporting media were modelled such that the structural behaviour could be predicted to a degree of accuracy needed for ascertaining soil parameters in the field in accordance with current practices. Mathematical modelling was completed and necessary software developed and tested. It was expected that this tool would help design engineers in understanding the behaviour of such buildings and producing distress-free economical design.

The Bureau of Indian Standards issued sometime back the revised code of practice, 'Criteria for design of structures for wind effects' (IS 875), incorporating the results of studies on the nature of wind and its loading on structures, carried out in India and abroad during the past 25 years. For an effective use of the revised code, the Centre was working towards bringing out an explanatory handbook giving some background information.

A software package for linear structural analysis of frame and shear wall buildings subjected to static and dynamic loading was successfully implemented at NIC and SERC computing systems. This involved the development of a machine-independent routine for sorting records on multiple keys. The package can analyze high rise-buildings as two- or three-dimensional entities.

An algorithm for computing dead loads of the structural system was completed. A program to compute dead load of slabs based on yield line theory was under development.

Several other powerful programs were also ported on NEC system at NIO and the SERC computing system. These include: SAP IV—general purpose finite element program for linear structural analysis; NONSAP—finite element program for non-linear structural analysis; COMPLEX—finite element program for the analysis of general nonprismatic folded plate structures and has powerful data generation capability; ETABS—program for three-dimensional static and dynamic analysis of building systems treating floors as rigid members in their own plane; SHORE III—program for static and dynamic analysis of axisymmetric plates and shells; SAKI—program for inelastic response of RC frames to earthquakes; and RC TANK—program package to carry out an approximate analysis design and estimation of Intze tanks.

Under the Drinking Water Mission of the Government of India, apart from tapping the groundwater and water from rivers and lakes, rain water harvesting and storage of collected water in hygienic containers has been identified as an important way to solve the water problem. Ferrocement tanks developed at the Centre were approved for mass scale adoption.

During the period, Centre conducted 14 training courses cum demonstrations in construction techniques for rain water harvesting schemes and ferrocement water tanks. The participants were provided full technical details and were trained in actual construction process for rain water collection systems, using roofs, platforms and hill slopes as catchment areas. The courses also covered various casting techniques for ferrocement tanks up to 20,000 litre capacities, using various methods and techniques. Sixty-four demonstration structures were constructed in rural areas of Meghalaya, Manipur, Nagaland, Tripura, Madhya Pradesh, Kumaon and Garhwal Hills of U.P., Rajasthan and Karnataka. The response to these programmes was very encouraging and many states have taken up construction of RWHS & FC tanks for solving their drinking water problem.

SERC completed design, casting and testing of ferrocement mini check dams of height 1.2 m. The development of technique for casting of ferrocement water filters and plates; design, casting and assembling of precast segments of wall roof and base of FC tanks for cylindrical units up to 20,000 litre capacity was also carried out. In addition, techniques for construction of underground water tanks and for FC lining of water tanks in laterite soils were also developed.

During the period, 39 papers were published, 10 papers were presented in symposia/seminars and 15 reports were prepared. Four special publications were also brought out. □

**CIMAP participates in Regional Science and Technology Fair at Jhansi**  
The Central Institute of Medicinal and Aromatic Plants, Lucknow, participated in the Regional Science and Technology Fair held

at Jhansi on 10-11 January 1991. The fair organized by the Uttar Pradesh Council of Science and Technology (UPCST) was first of the series of fairs to be held at various places in U.P. under the awareness programme of the Council.

Inaugurating the fair, the U.P. Minister for Science and Technology, Shri Vikramaditya Pandey applauded the role of UPCST in making the masses aware of the prevailing technologies in the state and making use of these technologies. Shri Pandey called upon the scientists to make best use of the locally available resources for developing technologies so that the common man is benefitted by these technologies.

CIMAP displays in the fair were related to the institute's R&D on crops like lemongrass, palmarosa, citronella, vetiver, Japanese mint and spearmint. The crops like lemongrass and palmarosa are quite suitable for areas like Jhansi, where water shortage is a severe problem, owing to which a large amount of land remains unsuitable for cultivation. The Minister, district authorities and local people showed a keen interest in these plants. A field distillation unit was also installed in the exhibition and visitors were demonstrated the extraction of oil from aromatic plants.

#### **Prof. B.R. Sant addresses FAPCCI meeting on Technology Transfer**

Prof. B. R. Sant, Scientist-in-Charge, CSIR Polytechnology Transfer Centre (PTC), Hyderabad, addressed a meeting of the Federation of Andhra Pradesh Chambers of Commerce (FAPCCI) on 7 December 1990, at the invitation of FAPCCI.

In his address Prof. Sant gave a general outline of the role of CSIR, its laboratories, NRDC and PTC in technology development and its transfer. He described the various steps involved in the technology

transfer, presenting a number of case studies. He specifically dealt with the projects on tiny cement plants, red oxide pigment and plant tissue culture, which have either been implemented or are under implementation in Andhra Pradesh, highlighting the problems of technology generator, the consultant, the financial institution and the entrepreneur.

Prof. Sant emphasized that the technology transfer needs an integrated approach. A proper feedback is essential each time the project is implemented. He also mentioned about the joint projects taken up by APITCO and PTC (Hyd.) on a few selected CSIR/NRDC technologies. The exercise involved screening of projects, preparation of bankable pre-investment reports and identification of suitable entrepreneurs. □

## **TRAINING COURSES**

### **RRL-Jammu Training Programmes on Vocational Trades in Rural Areas**

The Regional Research Laboratory (RRL), Jammu, organized the following eight training programmes during August-October 1990, under the 35-Point Programme of the Government of India, with the objective of imparting training in a variety of vocational trades in rural areas:

#### **I & II. Processing of Fruits and Vegetables**

This training programme was organized at Kalpa (Distt. Kinnaur, H.P.) from 13 to 20 August; 28 trainees participated. The participating agencies were: (i) Small Industries Service Institute (SISI), Solan, (ii) Kinnaur Mahila Mandal, and (iii) H.P. Department of Horticulture. Training was imparted in preparation of apricot wine, mixed fruit jams, apricot nectar and RTS



beverage, apple jelly, bulk processing and storage of apple pulp, and solar drying of fruits and vegetables.

This programme was also organized at Chopal (Simla Distt., H.P.) from 22 to 25 August 1990, along with the Entrepreneurship Development Programme of SISI; 37 trainees participated. Training was imparted in preparation of tomato pulp and ketchup, apple jelly and spiced chutney, debittering of bitter apricot kernel and oil, and drying of ginger and preparation of ginger powder and ginger candy.

### III. Solar Drying and Processing of Apricots

The training programme was conducted at Reckong Peo (Distt. Kinnaur, H.P.) from 13 to 20 August; 25 trainees participated. The University of Horticulture and Forestry, Solan; H.P. Directorate of Horticulture; District Industries Centre, Kinnaur and Industrial Training Institute were the participating agencies. Training covered various aspects of apricot processing like solar drying and packing, bulk processing and storage of pulp, preparation of nec-

tar, RTS beverage, jam, sauce, wine and debittering of bitter apricot kernel and oil.

### IV. Processing of Tomato Products

The programme was organized at Assar (Distt. Doda, J&K) from 10 to 16 September. DDC and District Industries Centre were the participating agencies. Thirty-five participants were imparted training in preparation of tomato products like ketchup, juice, soup, puree, crush, and canning of tomatoes in brine.

### V. Improved Processing of Anardana (*Punica granatum*)

This programme was organized at Assar from 10 to 16 September. DDC and DIC, Doda; Department of Rural Development of J&K were participating agencies. Thirty-five trainees attended this course. The participants were imparted training in scientific techniques of processing of anardana, including quality grading of raw material, solar and controlled drying, packaging, storage, fumigation to prevent insect infestation and development of value-added products.

### VI. Improved Processing of Apple and Quince

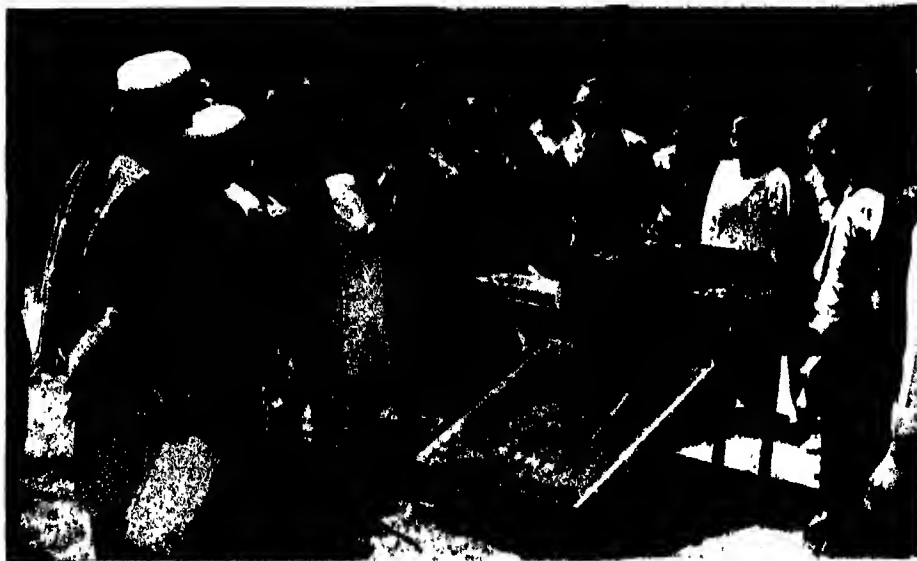
The training programme was organized at Bhaderwah (Distt. Doda, J&K); 30 trainees participated. The participating agencies were the DDC, Doda; Fruit Preservation & Community Canning Centre, Bhaderwah and J&K Horticulture Department. Through lectures and demonstration, the trainees were acquainted with drying of apple and quince, selection of raw material, processing, handling, peeling, coring, slicing, pre-treatment, sulphuring, drying and packing. Instructions regarding quality control and Indian Standards in this regard were also given.

### VII. Improved Technology on Post-harvest Processing of Saffron

Twenty-seven trainees attended the training programme, organized from 22 to 27 October at Berwar (Distt. Doda, J&K). The J&K Council of Science & Technology, Saffron Development Officer, Chief Agriculture Officer and Asstt. Registrar, Cooperative located at Kishtwar, where saffron is grown on commercial scale, participated in the programme. Practical information on improved post-harvest handling and processing of saffron was imparted. Demonstrations of flower harvester, saffron air separator, solar dryer, and laccha separator as well as improved packing and storage techniques developed by RRL, Jammu, were also given.

### VIII. Fresh Water Aquaculture

This five-day programme was organized at village Rara (Block Vijaypur, Distt. Jammu) from 20 to 24 August; 30 trainees attended the programme. The J&K Council of Science & Technology and J&K Department of Rural Development participated in the programme which covered different aspects of



Participants being explained the solar drying of apricots at the training programme held at district Kinnaur

aquaculture, viz. pond construction, varieties of fishes, fish spawning and reproduction, nursery management, spawn care, water testing and net weaving techniques, cultivation of aquatic plants (singhara and makhana), fish-cum-poultry and fish-cum-duck farming

### Honours & Awards

#### Prof. B.N. Gupta

Prof. B.N. Gupta, Assistant Director, Industrial Toxicology Research Centre, Lucknow, and a renowned dermatologist of the city, has been awarded the Dr D.S. Munagekar award of the Indian Medical Association for the best published research work in the field of medical sciences during 1989-90. The award carries a certificate, a citation and a cash prize. The award was presented to Prof. Gupta by the Chief Minister of Gujarat, Shri Chiman Bhat Patel at the 66th All India Medical Conference held at Ahmedabad on 28 December 1990. □

#### Dr N.R. Ayyangar retires

Dr N.R. Ayyangar of the National Chemical Laboratory (NCL), Pune, retired on 31 December 1990 on reaching the age of superannuation, after a distinguished career as an organic chemist.



Dr Ayyangar (born 21 Dec. 1930, Bangalore) after getting his

B.Sc. degree from the University of Poona, joined UDCT and obtained his B. Tech. degree in dyestuffs chemistry. He then became a member of the group of scholars working for their doctoral degree under the guidance of Dr K. Venkataraman, the then Director of NCL, and received his Ph.D. (Tech.) from the University of Bombay in 1960.

After completing post-doctoral research at the Purdue University and Illinois Institute of Technology during 1960 and 1964, he returned to India and joined NCL in 1965. He became Head of the Organic Chemistry II Division in 1985, and until his retirement in 1990, organized and conducted research of a very high order in organic synthesis.

An author of 120 research papers, a co-editor of two well-known books, and a holder of 30 patents, Dr Ayyangar was a member of the committee formed to investigate the Bhopal disaster, and the committee that investigated the explosion in the meta-aminophenol plant at HOC, Rasayani. As a result of the well-recognized contributions he made in these committees, he came to be regarded as an expert in industrial safety in the country.

His contributions in synthetic chemistry are no less significant. The new and/or modified synthetic methods that he and his group developed pertain to heterocycles, biologically active compounds, azides and nitrenes, hydroboration, and anthraquinones.

With the help of his group, he organized the development of an analytical kit for identifying narcotics and addicting drugs, at the instance of the Prime Minister's Secretariat. The process for producing the kit was taken up by the Hindustan Antibiotics Ltd, Pimpri, Pune, which produced 300 kits for use all over the country. Even an untrained person can use

the kit to test compounds suspected to be narcotics.

A two-day national symposium on Recent Trends in Organic Chemistry and Organic Chemical Technology was conducted on 20-21 December 1990 in his honour. The symposium was inaugurated by Prof. M.M. Sharma, Director, UDCT, Bombay.

Nearly 13 scientists from within and outside NCL delivered lectures on various topics in the field. Notable amongst the outsiders were Dr K. Nagarajan (Searle India), Prof. S. Chandrasekaran (IISc, Bangalore), Dr J.S. Yadav (IICT, Hyderabad), Prof. M. Nagarajan (University of Hyderabad), Prof. S. Seshadri (UDCT) and Dr A.M. Malte (Gharda Chemicals, Bombay) besides Prof. Sharma and Dr A.V. Rama Rao, Director, IICT, Hyderabad. Dr Rama Rao delivered the plenary lecture on 'Chiral Technology—Emerging Trends for the Nineties'.

### PATENTS FILED

1023/DEL/90: A process for the preparation of Z-3-dodecenyl E-2'-butenoate, N.S. Mani and M.S. Nair — Regional Research Laboratory, Trivandrum.

1024/DEL/90: An improved process for the manufacture of linear alkyl benzenes, A.R.A. Deshmukh, V.K. Gumaste, V.P. Shiralkar and B.V. Bapat — National Chemical Laboratory, Pune.

1025/DEL/90: A process for the preparation of crystalline vanadium titanium silicate, A.V. Ramaswamy, P.R.H. Rao and A. Thangaraj — National Chemical Laboratory, Pune.

1026/DEL/90: An improved process for the synthesis of 4-2-alkoxy ethyl phenol, A.V.R. Rao, M. K. Gurjar and S. V. Joshi — Indian Institute of Chemical Technology, Hyderabad. □

# CSIR NEWS



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## IN THIS ISSUE

Dr. S.K. Joshi takes over as Director General, CSIR	87
Dr. A.P. Mitra awarded Bhatnagar Fellowship	87
Business Meeting of CSIR Technology Transfer and Marketing Personnel	89
Workshop on Innovative Foundation Techniques in Soft Soil	90
Biosynthesis and Degradation of Methylglyoxal in Mammalian Liver—Dr Manju Ray's Bhatnagar Prize-winning work	91
Document on Rural Road Development in India	92
Microprocessor-controlled Thermal Analyzer installed at CFRI	94
NBRI Annual report: 1988-89	95

Centchroman, a non-steroidal oral contraceptive for female, developed by CDRI, Lucknow and earlier licensed to the Hindustan Latex Ltd, Trivandrum, was released by the firm on 17 February 1991 for marketing under the trade names Choice-7 and Saheli. A report on fortieth anniversary celebrations of CDRI appears on p. 86.

## CENTRAL DRUG RESEARCH INSTITUTE, LUCKNOW Significant Achievements of Four Decades

The Central Drug Research Institute (CDRI), Lucknow, celebrated its 40th Annual Day on 17 February 1991. The Annual Day was marked with several distinct features: Presentation of the summary of institute's achievements during 40 years, including those during 1990, by the institute's Director, Prof. B.N. Dhawan; release of institute's contraceptive pill Centchroman by the Hindustan Latex Ltd, Trivandrum; release of CDRI 40th year Commemorative issue of *Indian Journal of Chemistry*; and release of institute's five publications, viz. *Central Drug Research Institute R&D Highlights (1951-1990)*; *Compendium of Indian Medicinal Plants (1960-1969)*, Vol. I, *Bibliography of CDRI Research Contributions (1951-1990)*; *40th Year Souvenir* and *Annual Report 1990-91*. An exhibition on achievements of CDRI was also organized on this occasion along with a stall by the Publications & Information Directorate, New Delhi; the exhibition was formally inaugurated by Dr Ram K. Iyengar, Additional Director General, CSIR. The Annual Day Programme was graced by the presence of Dr A.P. Mitra, the then Director General, CSIR, who presided over the function; Dr A.S. Paintal, Director General, ICMR, as the Chief Guest; and Dr P.N. Tandon, Bhatnagar Fellow and Chairman, CDRI Research Council; Shri S.B. Misra, Joint Secretary, Ministry of Family Welfare; Members of CDRI Research Council and Directors of seven CSIR laboratories.

Welcoming the distinguished guests, Prof. B.N. Dhawan, Director, CDRI, commenced his speech by paying tribute to pioneers and stalwarts who guided the institute

through initial stages of its development. About institute's objective, he said, it continued to be development of new therapeutic, diagnostic or prophylactic agents in priority areas of National Health Care, basic research in related biomedical areas, studies on natural products including the drugs used in traditional systems of medicine, technology for bulk drugs and human resource development in areas of drugs, pharmaceuticals and adjunct disciplines.

Giving global statistics, he pointed out that one marketable drug emerges from a study of around 10,000 compounds, taking on an average 10-20 years period and 200 million US dollars investment. He said that the institute's five drugs released for marketing, viz. Centchroman — a weekly non-

steroidal oral contraceptive, Gugulipid — a hypolipidaemic agent from *Commiphora mukul*, Centmizone — an antithyroid agent, Centbucridine — a local anaesthetic and Centbutindole — a neuroleptic, and Isaptent I and II for medical termination of pregnancy and a dermal diagnostic test for filariasis indicated a much better output by CDRI than the global indicators. On process technology front, he said, CDRI had developed 75 chemical and fermentation technologies out of which nine were under production and several had won national level awards of excellence.

Speaking of contributions in the field of medicinal plants, Prof. Dhawan said that 4,000 species of terrestrial plants including those used in traditional systems of medicine, and 600 species of

→ p.88



Prof A.S. Paintal, Director General, ICMR, releasing CDRI Annual Report: 1990-91 on the occasion of fortieth anniversary celebrations at CDRI. Others seen on the dais (from left) are: Dr P.N. Tandon, Dr A.P. Mitra and Dr B.N. Dhawan

## **Dr S.K. Joshi takes over as Director General, CSIR**

Dr Shri Krishna Joshi, Director, National Physical Laboratory (NPL), New Delhi, has been appointed Director General, Council of Scientific & Industrial Research and Secretary, Department of Scientific & Industrial Research. He took charge from Dr A.P. Mitra on 18 April 1991. He is the eleventh Director General of CSIR.



Dr Joshi (born 6 June 1935) has had a brilliant academic career, obtaining first division all through from high school to M.Sc. He was awarded Ward-Vidyant Gold Medal of the Allahabad University for standing first in M.Sc. Physics (1957). He obtained his Ph.D. degree (1962) from the Allahabad University for his thesis: 'Study of Diffuse Scattering of X-rays'.

Dr Joshi has taught and guided basic research in universities for 30 years. He served as a Lecturer in Physics, Allahabad University during 1957-67. He was a Visiting Lecturer, University of California, Riverside, USA (1965-67), and Professor,

Physics Department, Roorkee University (1967-86). He was Head of the Physics Department of the Roorkee University during 1967-78 and 1984-86. He took over as Director, NPL, in November 1986.

Dr Joshi's areas of specialization are solid state physics and atomic and molecular physics. His current research interests include the study of: electrons and phonons in disordered systems transport and optical properties of disordered alloys; lattice dynamics of transition metals, surface and interface states in semiconductors; spin glasses; material science and science management.

He was awarded the Watumull Memorial (Prize (1965) for the best research work done in India during 1964 by the Watumull Foundation, Honolulu, USA; Shanti Swarup Bhatnagar Prize for Physical Sciences (1972); UGC National Lectureship (1973); CSIR Silver Jubilee Award (1973) and Meghnad Saha Award for Research in Theoretical Sciences (1974) by UGC (Hari Om Ashram Trust Award). He was conferred the Presidential Honour, Padma Shri, in 1991.

He had the honour of being the Vice-President, Indian Physics Association (1973-74); and Associate (1971-75) and Senior Associate (1978-82) of International Centre for Theoretical Physics, Trieste, Italy. He has been the Fellow of the Indian National Science Academy since 1974 (Secretary of the Academy 1983-86); and Fellow of the Indian Academy of Sciences since 1974. He has visited several countries like USA, Italy, UK,

France, Belgium, China and Germany.

He has supervised 17 Ph.D. theses so far and has more than 155 research papers to his credit. □

## **Dr A.P. Mitra awarded Bhatnagar Fellowship**

Dr A.P. Mitra, FRS, who had been the Director General of CSIR since 1986, has been awarded the Bhatnagar Fellowship for five years.



The originator of the widely used cosmic radio noise technique for exploring the ionosphere and one of the world pioneers in atmospheric chemistry, Dr Mitra piloted the IGY Programme some thirty years ago and has been the principal figure behind the development of a strong base in ionosphere physics in India. As a Bhatnagar Fellow, Dr Mitra will participate in the thrust area programmes of CSIR, taken up on mission mode in his area of excellence. To pursue these research programmes, he will be provided with an appropriate research budget and necessary manpower and infrastructure facilities. □

marine flora and fauna had been evaluated in a broad-based biological screen and several leads were being developed as potential drugs for tropical infections, liver and cardiovascular disorders and as spermicides, anti-inflammatory agents, etc. and several biologically active new and unusual structures had been discovered.

The institute had filed 220 patents, published about 5000 research publications, 330 Ph.D. theses and 15 books. Several scientists had won recognition in the form of 17 INSA Fellowships, five Shanti Swarup Bhatnagar prizes and a number of other prestigious national awards.

Over the years, several national level facilities set up at the institute, viz., the Regional Sophisticated Instrumentation Centre (RSIC), National Information Centre for Drugs & Pharmaceuticals (NICDAP) and the National Laboratory Animal Centre (NLAC), besides two WHO collaborative Centres and one ICMR Advanced Centre had provided valuable services.

While presenting the institute's progress report for 1990, Prof. Dhawan said that the major landmark during the year was successful development of Centchroman, its licensing to the public sector undertaking, Hindustan Latex Ltd, Trivandrum and its approval for introduction in the National Family Welfare Programme. He lauded the role of dedicated scientists and clinical investigators, and of Shri J.C. Jetly, Secretary, Department of Family Welfare; Dr G.K. Vishwakarma, Director General of Health Services, Government of India; Prof. Banoo Coyaji, Directorate of Family Welfare, U.P. and the officials of the Hindustan Latex, which led to the ultimate marketing of Centchroman. Progress was made in phase III clinical trials with Centchroman in cancer treatment

of breast, Centpropazine (antidepressant) and Chandonium iodide (neuromuscular blocking agent); phase II studies with Curcumin in rheumatoid arthritis, cervical spondylitis and chronic osteoarthritis and phase I studies with compound 80/53 and arteether (anti-malarials) and 80/574 (hypolipidaemic). Phase I studies were initiated with Picroliv (hepatoprotective) and compound 73/602 (antiallergic) and permission for clinical trials obtained for Centbutindole injection and the compound 81/470 (anthelmintic).

Prof. Dhawan said, there was a significant reduction in the time taken for clearance from the Drug Controller but unfortunately permission for *M. habana* vaccine was still awaited. He hoped that with so many new compounds under development in a mission mode, the institute should be able to release new drugs regularly during the next decade.

Interesting results were obtained in the field of natural products and traditional remedies: lupeol from *Crataeva nurvala* prevented formation of vesical calculi and reduced preformed calculi; antileishmanial activity of arboristricosides was established in low doses; and macrofilaricides from *Streblus asper* were chemically modified to minimize their undesirable cardiotoxic activity. Other developments included isolation of a new hypotensive triterpenoid from *Coleus forskohlii*, evaluation of an ELISA test for leishmania on a larger population and development of hybridomas secreting anti-promastigote antibodies for leishmania and against antifilarial antigens for antigen detection tests.

Reporting on the National Facilities, Prof. Dhawan said that RSIC analyzed over 9,000 samples; NICDAP had been designated as the Information Centre for Bioactive Agents from the Sea by the

Department of Ocean Development; Department of Biotechnology and CSIR had agreed to provide NLAC, a funding of Rs 28.5 million during the VIII Plan for developing a modern infected animal containment facility and Rs 14 million for a new building, respectively; ICMR Advanced Centre on Traditional Remedies completed another year of successful activity in spite of a shoestring budget.

Prof. Dhawan said that ICMR funding for projects needed to be revitalized. He informed that CDRI was the coordinating laboratory of the Department of Ocean Development's new National Programme for Drugs from the Ocean flora and fauna encompassing 10 laboratories and with a funding of about Rs 20 million for 3 years.

During the year, the institute continued to provide training to candidates from India and abroad. CDRI scientists published 215 research papers, 14 book chapters, edited 3 books and filed 16 patents.

Several CDRI scientists received recognition: Dr D.S. Bhakuni and Dr A.P. Bhaduri, the Ranbaxy Research Foundation Award in Chemical Sciences; Dr B.L. Tekwani, the CSIR Young Scientist Award; Dr Vinod Bihari, the Raman Research Fellowship; Dr (Smt.) N. Kaushal, the Biotechnology National Associateship; and Shri Pradeep Kumar, the Outstanding Young Person of the World Award in the area of academic leadership and accomplishment from the U.S. Junior Chamber International.

Prof. Dhawan further said that due to several new agreements signed for technologies and products, the institute's royalties and premia were expected to reach Rs 4 million. Contracts had been finalized with firms for safety evaluation and to study dermatological products from natural sources and a German firm had



proposed collaboration on a new antileprosy drug with premium-free commercialization in India by

Prof. Dhawan said that as a part of the 40th year celebrations several symposia/workshops were organized and distinguished lectures were delivered by eminent scientists: Prof. P.N. Tandon, Prof. S. Ranganathan, Prof. S. Bergstrom, Prof. M.M. Sharma, Prof. V. Ramalingaswamy, Prof. M.S. Vallathan, Dr U. Ko Ko and Prof. Obaid Siddiqui. Prof. U.K. Sheth delivered this year's Mellanby Memorial Oration on 16 February 1991. The Hindi Committee of the Parliament led by Shri Atal Behari Vajpayee appreciated institute's efforts to increase the use of Hindi.

Institute's participation in the National Technology Fair at Madras during October 1990 fetched the Best Accomplishment Award.

Prof. Dhawan said that steps had been taken to strengthen institute's capabilities in computer-aided drug designing, protein engineering and new drug delivery systems. Efforts were also directed on marine products and creation of facilities for behavioural studies in non-human primates, a parasite bank and central tissue culture laboratory. He added that the institute's herbarium with its largest single collection of medicinal plants in India needed to be developed as a national reference centre and repository. He said efforts were on to procure high voltage Scanning Tunneling Electron Microscope. A major new addition this year was the computer-coupled FAB Mass Spectrometer at a cost of Rs 7 million.

The Director's address was followed by felicitation of institute's former Directors Dr Nitya Nand and Dr M.M. Dhar by Dr A.P. Mitra. Institute's four publications were released on this occasion. The book

*Compendium on Indian Medicinal Plants*, Vol. I (1960-1969) by Dr R.P. Rastogi and Dr B.N. Mehrotra, jointly published by CDRI and Publications & Information Directorate (PID), New Delhi, was presented by Dr G.P. Phondke, Director, PID, to Dr A.P. Mitra for release. Institute's nonsteroidal oral contraceptive pill Centchroman was also released on this occasion by Hindustan Latex Ltd, Trivandrum, for marketing under trade name Choice-7 and Saheli.

Dr A.S. Paintal, the Chief Guest, lauded the efforts made by CDRI in developing new drugs based on ancient wisdom of traditional systems of medicine like Ayurveda. He said that Indian scientific advancement had suffered owing to lack of confidence in ourselves. He hailed the release of Centchroman as an oral nonsteroidal contraceptive but said that it should not have taken so long to clear it for marketing.

Dr Mitra in his address remarked that CSIR had made significant progress in drug research, with CDRI playing an important role. The CSIR in general had exceeded the limit set forth by the Abid Hussain Committee in revenue generation to the extent of 33%, Dr Mitra added. Prof. P.N. Tandon, Chairman, CDRI Research Council, expressed satisfaction on the progress made by the institute. He said the institute was faced with the problem of delay in obtaining permission from regulatory agencies and the institute's leprosy vaccine awaited clearance for clinical trials despite submission of data some 18 months ago.

Later, Dr Mitra felicitated CDRI employees who had completed 25 years service in CDRI.

At the end, Dr V.P. Kamboj, Deputy Director and Chairman 40th Anniversary Organising Committee presented a vote of thanks. □

## **Business Meeting of CSIR Technology Transfer and Marketing Personnel**

The third annual Business Meeting of CSIR Technology Transfer and Marketing Personnel was held at the Indian Institute of Chemical Technology (IICT), Hyderabad, on 4 & 5 February 1991. Around fifty representatives of the CSIR Hqs. and its laboratories and PTCs met to discuss and resolve difficulties and problems pertaining to: (a) technology transfer and marketing; (b) revision in manpower charges; (c) strategies for marketing the new commercializable components of knowledgebase, namely international competitive bidding and computer software; and (d) guidelines for knowledgebase contracts with foreign clients. Two other important issues that significantly contribute to enhancing the value of marketable knowledgebase, viz. the 'Elements

of a Bankable Project' and 'Early Identification of Potential Innovations', were also considered.

Inaugurating the meeting, Dr A.V. Rama Rao, Director, IICT, brought to light the unique nature of CSIR as an organization where science is pursued not merely for its own sake but with the objective of generating technology for development. Scientific research at some stage acquires commercial value. Therefore, it was important to involve industry/users in the R&D projects. In this way CSIR can also make up for the want of expertise needed for taking the technology to commercial fruition. He deprecated the unhealthy tendency to take up more 'consultancy' projects per se by laboratories and also to building in a component of consultancy in all contract re-



Dr H R Bhojwani addressing Third Business Meeting of CSIR Technology Transfer and Marketing Personnel, held at IICT, Hyderabad

Government of India approvals needed for taking up projects of foreign clients.

In a general discussion the participants expressed a desire to have a uniform nomenclature in all laboratories for the unit/group dealing with technology transfer and marketing, as this would facilitate internal/external interaction, etc. TUD was requested to take up the matter with the laboratory directors. Another important general issue discussed was the conducting of training programmes in marketing of knowledgebase for the laboratory personnel; TUD agreed to organize such programmes. The Fourth Business Meeting was decided to be held at IIP, Dehra Dun, in February/March 1992. □

search projects. Consultancy, he said, strictly speaking, meant imparting expert advice and knowledge only and not the use of laboratory infrastructure.

The session on 'Manpower Charges' was chaired by Shri N.C. Aggrawal, IFA, CSIR, wherein Shri P.K. Jain of IIP presented a paper on 'Costing of mandays', and Shri Hemraj, DFA, made a comprehensive presentation on calculation of manpower costs for the various categories of S&T staff. It was decided that CSIR should have only two rates of manpower charges, one for scientists up to the 'E' level and other for senior scientists (above 'E' level). In the session on 'Stimulating Protection for Innovations', Dr K.K. Mishra of NML made an interesting presentation on discerning innovation at the nascent stage and the importance of protecting it through patenting. In the session on 'New Avenues for Marketing Components of Knowledgebase', Shri Hirwani of NCL made a comprehensive and instructive presentation on the procedures, protocols and opportunities for international competitive bidding for projects. It was decided that the Technology Utilisation Division at CSIR would render the service of locating and identifying such projects of interest

to CSIR and, in association with concerned laboratories, put together the bid offer. For marketing of software, it was felt necessary to 'package' software for greater marketability, and this could preferably be done in association with software vendors.

The session on 'Elements of a Bankable Project' was chaired by Shri Baldev Singh, ex-Chief, TUD, and presentations were made by Managing Director, APITCO, and Deputy Manager, IDBI. It was emphasized that an entrepreneur basically seeks an adequate return on his investment, and to help him decide this, CSIR should provide adequate information on economic and market viability, etc. besides details of technology. CSIR needs to devise mechanisms for enhancing the value of its know-how and it should consider whether this could be done independently or through consultants. The draft guidelines for 'Knowledgebase Contracts with Foreign Clients', prepared by TUD, were discussed in detail. The guidelines were accepted with minor modification in the charges suggested for 'developed' and 'developing' countries. In conformity with the general philosophy of devolution of autonomy, the CSIR Hqs would be involved only with respect to

### Workshop on Innovative Foundation Techniques in Soft Soil

At the invitation of the Institution of Engineers, Maharashtra State Centre, Bombay, a two-day workshop on Innovative Foundation Techniques in Soft Soil, was conducted by Dr B.G. Rao, Scientist, Central Building Research Institute (CBRI), Roorkee, during 24-25 January 1991, at Bombay. Dr Rao delivered two key-note lectures covering the following techniques developed at the Institute: Granular pile foundation; Mini-pile foundation, and Self-setting soil, slurry piles, with geofabric reinforced pile cap.

Dr Rao demonstrated with the help of slides and various data collected during the various R&D experiments, that considerable load-carrying capacity of soft saturated clay deposits, i.e. marine clay, can be increased by adopting the right combination of various techniques enumerated above. He suggested that a lot of land in and around

BMRDA area which is not utilized because of the heavy cost of foundation can be utilized for construction of housing projects within reasonable cost. He remarked that a minimum of 30% reduction in foundation cost can be achieved for a sizeable project.

The participants were taken to the actual worksite where such techniques were being used and shown the demonstrations with actual load testing, the efficiency of the various techniques developed by CBRI.

A lecture was also delivered by Shri M.P. Jain, Scientist, CBRI, on Spliced piles technology. A full scale field demonstration of spliced

pile installation and testing was shown at the site near Bhayandar Creek.

The delegates were sponsored by organizations such as Indian Oil Corporation, Nuclear Power Corporation, CIDCO, Godrej, STUP Consultants Ltd, and AFCONS.

Various government departments, semi-government and private sector organizations are negotiating to utilize consultancy of CBRI for ground improvement techniques and have shown interest in utilizing the technologies in the actual building construction. One such department has initiated the formalities of giving a turn-key assignment for New Bombay areas to CBRI. □

biosynthesis of methylglyoxal was also demonstrated to be operative by Dr Ray in mammalian plasma. Two enzymes, the classical amine oxidase and a newly discovered aminoacetone oxidase were fully characterized. Both the enzymes could convert aminoacetone to methylglyoxal though the second oxidase showed an absolute specificity for the substrate. Finally, synthesis of aminoacetone itself was shown to occur independently from two common metabolites, threonine and glycine. Both the enzymes, threonine dehydrogenase and aminoacetone synthase were completely purified to homogeneity and fully characterized from goat-liver.

After the establishment of the biosynthetic routes for methylglyoxal production, the catabolic channels were also investigated for which two routes were identified. An NAD(P) dependent methylglyoxal oxidation, catalyzed by keto-aldehyde dehydrogenase, was demonstrated after homogeneous preparation of this enzyme from goat-liver. Finally, conversion of methylglyoxal to L-lactic acid (the physiological isomer) was demonstrated by isolating two enzymes, namely methylglyoxal reductase and the conventional cytosolic aldehyde dehydrogenase. Stoichiometric formation of lactaldehyde in presence of the reductase was demonstrated.

In all, seven enzymes have been detected and fully characterized from mammalian system, all of which are involved in methylglyoxal metabolism. Threonine, glycine and dihydroxyacetone phosphate, all known metabolites, can serve as precursors of methylglyoxal. The compound, in turn, can be smoothly converted either to pyruvic acid or to L-lactic acid directly. Preliminary work has also indicated some regulatory role for this compound.

## Biosynthesis and Degradation of Methylglyoxal in Mammalian Liver

Dr Manju Ray's Bhatnagar Prize-winning Work\*

The status of methylglyoxal, a ketoaldehyde, as a metabolite remained an enigma and a challenge to many celebrated biochemists till Dr Manju Ray, working independently in a small Indian laboratory, started to identify, isolate, purify and characterize a series of enzymes that are involved in the biosynthesis and degradation of the compound in mammalian liver.

Methylglyoxal was originally suggested by Neuberg as an intermediate of glycolysis but was later discarded as an artifact after Embden-Meyerhof pathway was firmly established. Racker worked out mechanism of glyoxalase I & II, enzymes that convert methylglyoxal to D-lactic acid, a non-physiological isomer, but had no clue of metabolic status of methylglyoxal. Szent-Georgyi

revived interest in the compound when a growth-regulatory and carcinostatic role for the compound was suggested.

Taking a lead from bacterial systems, Dr Manju Ray demonstrated the presence of an enzyme in mammalian liver that could synthesize methylglyoxal from dihydroxyacetone phosphate, a known intermediate of glycolysis. Designated as methylglyoxal synthase, this enzyme provided the first evidence for biosynthesis of methylglyoxal in vertebrate system. An alternative route for



\*Dr Manju Ray of the Calcutta University, Calcutta, has been awarded the 1989 Shanti Swarup Bhatnagar Prize in Biological Sciences (along with Prof. S.C. Lakhota of the Banaras Hindu University, Banaras) [CSIR News, 40(1990) 221 & 41(1991), 14].

Dr Ray (born 1 Jan 1947) did her B.Sc. (Physiology Hons)(1967), M.Sc.(Physiology)(1969) and Ph.D.(Biochemistry) (1975) from the Calcutta University.

She was Junior Research Fellow (June 1970-May 1973) and Senior Research Fellow (June 1973-July 1976) of ICMR, Research Associate (Aug 1976-April 1986) of UGC-CSIR. At present she is Research Scientist B of UGC. Dr Ray is member of the Society of Biological Chemists, India. She is recipient of various honours/awards : Gold Medal for obtaining first rank in M.Sc.examination of the Calcutta University; UGC travel fellowship for attending IX International Congress at Stockholm, Sweden (1973); INSA Young Scientist Medal for 1975 for postdoctoral work on galactose metabolism and enzymological work on UDP glucose 4-epimerase, a model oxidoreductase; IUB Fellowship (twice) for attending XI and XII International Congress of Biochemistry in Toronto, Canada, in 1979 and in Perth, Australia, in 1982, respectively. She has 27 research papers to her credit. □

### **Document on Rural Road Development in India**

Recognizing the vital role of roads for an all-round integrated development of the rural India, the Government of India included in the 20-Year Road Development Plan (1981-2001), all-weather connectivity to the six lakh villages. The plan envisages construction of more than 11 lakh kilometres of rural roads requiring substantial financial investment. In addition to the huge expenditure, aspects such as variations in terrain, climate, availability of road material, composition of traffic, etc. prevailing in our country, make the implementation of the programme a challenging task. The science of road building has undergone a phenomenal change around the

world in the recent years. Though the scientific information and technologies are indigenously available for proper planning and construction of rural road network in the country, a good deal of information is lying scattered and needs to be compiled in a single comprehensive document. To derive maximum benefit from the available knowledge, a need was felt for collating the required information for the use of personnel involved in the rural road programme, ranging from planners and designers to the field workers at the grass-root level.

The Central Road Research Institute in New Delhi devotes considerable attention towards the planning, design and construction of rural roads. Some of the technologies developed in the institute have resulted in considerable savings in the road construction costs. Likewise, the institute has pioneered a system approach for developing a planning model wherein a road network needed for providing adequate accessibility can be generated in the form of minimal spanning 'trees' and also for prioritization of a road link on the basis of total construction cost versus travel cost. In view of the expertise available at the institute, the task for preparing an integrated document on Rural Road Development was assigned, at the instance of the Planning Commission, to CRRI by the Council for Advancement of People's Action and Rural Technology (CAPART), the Ministry of Surface Transport and the Ministry of Agriculture (Rural Development). Dr N.B. Lal, former Head, Soil Stabilisation and Rural Roads Division, CRRI, with the assistance of the members of the Division, and under the guidance of Dr M.P. Dhir, former Director of the institute, and Advisory Committee of academicians, field engineers and administrators made dedicated efforts to prepare

the document which has been recently released.

The document is in two volumes. In Volume-I, the present level of road accessibility in rural areas of different states of the country, the rural road development programmes undertaken as also the accrueable socio-economic benefits from providing the adequate road accessibility, have been brought out in detail. Incorporated in this volume are also the various planning methodologies in vogue, the latest R&D activities in the allied field and also the important aspects of rural road management and funding programme.

The Volume-II deals with various engineering aspects covering alignments, design, construction techniques and maintenance measures for rural roads with emphasis on low-cost drainage system for rural roads and guidelines for maximal utilization of locally available materials in place of conventional hard stone materials, sources for which are fast depleting in the country. Owing to the constraints of technical manpower shortage and non-availability of needed equipment in the remote and scattered locales of rural roads, it has not always been possible to achieve quality works. To obviate these difficulties, intermediate, but feasible in these remote locations, quality control measures with the needed machinery which are technically adequate, have been developed by this institute. These have also been included in Volume-II alongwith illustrated guidelines for maintenance of rural roads.

Both the volumes are the result of search and evaluation of the large amount of information available and have been prepared on the basis of the field-experience of the compilers. Volume-I is intended mainly for the policy makers at various levels, funding departments and those responsible for

the management and organization concerned with the development of the rural roads. Volume-II is designed keeping in view the prevalent constraints under which the labour intensive technologies of the rural road construction are followed in the country. The guidelines set forth the measures, which are achievable in the field with the resources available to meet the basic engineering requirements for creating a permanent road asset.

Enquiries pertaining to the title publication may be directed to: The Director, Central Road Research Institute, New Delhi 110 020. □

### **Studies on Structural Composition of Indian Crude Oils by Modern Analytical Techniques**

Shri R. Nageswara Rao, while working at the Analytical Chemistry Division of the Indian Institute of Chemical Technology (IICT), Hyderabad, carried out studies on structural composition of Bombay High and Ratnagiri crude oils by  $^1\text{H}$  NMR,  $^{13}\text{C}$  NMR, GC-MS and computer-aided techniques. Bombay High and Ratnagiri crudes (BHC and RGC) are produced off-shore west-coast of India from the Arabian sea. They are waxy ( $\approx 14.5\%$ ) in nature with high pour points ( $30^\circ\text{C}$ ) and low sulphur ( $< 0.2\%$ ) contents. The yields of their distillates are quite high ( $\approx 60\%$ ) when compared to the crudes that are produced/processed in India. Hence, these are more desirable not only from economical but also environmental point of view. However, their handling and transportation has been associated with several problems, and demands special attention for optimizing their utility. Generally, such problems are overcome by heating the crudes precisely, using water emulsions and treating the chemical additives as pourpoint depressants. These crudes when

tested with commercially available pourpoint depressants behave quite differently. BHC responds to a large number of pourpoint depressants while RGC does not. To understand this anomaly, an extensive analytical programme has been undertaken to simplify and systematize the search for right additives.

BHC has been characterized earlier by various techniques. However, these investigations do not throw light on structural composition of distillate fractions below the gas oil range. RGC is considered as virgin, since work on its characterization has not yet been reported. In the present investigation, BHC and RGC have been characterized systematically by  $^1\text{H}$  and  $^{13}\text{C}$  NMR spectrometry due to its distinct advantages over other analytical techniques.

BHC and RGC were fractionated into distillates (each 10% v/v) and residues following ASTM-D 86/285 method. The hydrogen and carbon distribution data obtained from NMR spectra were used to derive the chemically significant structural parameters, viz. aromaticity (fa), number of substituent rings (r), branchingness index (BI), compactness index (fc) and average chain length (ACI). A comparison of these data by Stepwise Discriminant Function Analysis (SDFA) showed definite variation in their structural compositions. The fa values for corresponding fractions BHC and RGC were found to differ considerably. Their magnitudes suggested that the fractions of RGC are more aromatic and less paraffinic in nature than those of BHC. The study also showed that the paraffinic chains in RGC are more branched than the BHC. Their aromatic substitution ratio is also slightly higher than BHC. The asphaltenes differ widely in their structural compositions. They have unusually high preponderance of long chain paraf-

ins substituted on aromatic rings. Hence, they interfere with wax crystallization process and lose their activity as natural pour point depressants. It may be due to these reasons that the commercially available pour point depressants which are more aliphatic in nature respond to BHC but not to RGC.

During these studies, a novel computer-assisted  $^{13}\text{C}$  NMR spectrometric method for the analysis of organic mixtures (CANOM) was developed. The software package for CANOM and a simulated library for 207 hydrocarbons containing chemical shifts and multiplicity data were prepared. The results obtained indicate that CANOM is a complementary technique to GC-MS.

The distillate residues were separated into asphaltenes, resins and de-asphaltened oils by Striter method. The surface energies of asphaltenes were found to be very low, indicating the intermolecular agglomerations. The degree of substitution ( $\sigma$ ) and the length of alkyl substitution ( $\rho$ ) for respective fractions of BHC and RGC differed considerably. The shapes of aromatic sheets for asphaltenes of BHC and RGC were found to be naphtho-2', 7', 1, 13-ovalene and 4,5,6,7-dibenzonaphthacene respectively.

For predicting the average molecular structures, a new technique, Computer-Assisted Molecular Structure Construction (CAMSC), introduced by Oka *et al* was modified and applied successfully for the aromatic components of BHC and RGC. The data obtained by CAMSC and IR revealed that the structures of BHC and RGC are quite different.

A detailed analysis of the waxes separated from these crudes showed striking differences. The waxes of RGC were found to be more polar than those of BHC. The gel-permeation chromatographic (GPC) studies also indicated variations in the distribution of carbon

numbers. Keeping in view these observations, models of compatible polymers were designed. They were prepared by synthesizing 7-oxo alcohols, ranging in carbon number C<sub>12</sub>-C<sub>24</sub> for the first time in the Hyderabad laboratory.

These molecules marginally increase the degree of polarity for polymers/copolymers with vinyl benzoates and phenyl acrylates. This helps in dissociating asphaltene molecules to prevent their interference with wax-additive interactions. The performance evaluation of these polymers showed their effectiveness on RGC to an extent of lowering its pour point by 9°C at 300 ppm level. These results substantiate the dependance of activity on structural parameters at molecular level. The study concludes that the structural compatibility of polymers with high pour waxy crudes is of supreme importance in designing effective pour point depressants as flow-improvers.

Shri Rao was awarded Ph.D. degree in Chemistry by the Osmania University, Hyderabad, for the above studies. He worked under the guidance of Dr Sajid Husain, Scientist F and Head, Analytical Chemistry Division, IICT. □

### **Microprocessor-controlled Thermal Analyzer installed at CFRI**

The Central Fuel Research Institute (CFRI), Dhanbad, has installed at its premises a highly sophisticated microprocessor-controlled thermal analyzer for characterization of minerals associated with coal and lignite, and catalysts. The instrument has been procured from M/s Thermal Sciences, U.K.

Dr Ram K. Iyengar, Additional Director General, CSIR, during his visit to the institute on 7 February



Dr R K Iyengar being explained the working of the microprocessor-controlled thermal analyzer at CFRI

1991, was shown the working of the instrument. He had a thorough discussion with the concerned scientists and hoped that studies on characterization of coal ash would lend active support to the R&D programme on utilization of fly ash from thermal power stations.

CFRI has already contributed towards the gainful utilization of this waste material by developing a

process for the production of building bricks with fly ash. The process has already been commercialized. M/s Jagatdhatri Brick Industries (P) Ltd at Barrackpore in West Bengal is producing 10,000 bricks/shift with the CFRI process. Two more commercial units with the CFRI technology are likely to be set up — one at Bandel with a capacity of 10,000 bricks/shift and the other at Raichur with a capacity of 30,000 bricks/shift. □

### **Prof. B.R. Sant delivers key-note address at National Symposium on Mineral Processing and Mineral Beneficiation**

Prof. B.R. Sant, Scientist-in-charge, CSIR Polytechnology Transfer Centre (PTC), Hyderabad, delivered a key-note address on 'Mineral Conservation', at the National Symposium on Mineral Processing and Beneficiation', organized by Sri Venkateswara University Post Graduate Centre in collaboration with UGC, at Cuddapah, during 24-25 January 1991.

In his address, Prof. Sant discussed the strategy of small scale

mining which gives increased gross domestic production, better quality assurance, employment generation, and less environmental pollution. He stressed the need for rehabilitation of abandoned mines through plantation of economic trees like oil seed bearing trees and described the work of CSIR in this regard. He also emphasized the need for utilizing mining wastes, overburdens and ore fines, citing the example of limestone overburdens which can be used as a con-



venient feed for tiny cement plants in the region.

Prof. Sant called upon the scientists to be on look out for high-value trace elements like cadmium, cobalt, selenium, tellurium and strontium, during the chemical analysis of raw and partially processed ores and minerals. Identification of such rare metals can form the basis of their recovery; for instance gallium and vanadium are recovered during bauxite processing in alumina plants. He also described the scope of mineral-based industries in the Rayalaseema region, especially those concerned with inorganic chemicals, building materials, refractories and ceramics.

### International Conference on Management of Change through HRD

Presiding over the Technology Transfer Session at the title conference held in Hyderabad during 7-9 February, Prof. Sant presented his views on the changing scenario of 'energy' and 'environment' in relation to Human Resource Development. He expressed the need, especially for developing countries, to look for alternative energy sources, recycling of wastes, pollution-free technologies (e.g. biotechnology for minerals, catalytic reactions at ambient temperatures), increasing use of animal power and scaling down of operation (small scale mining, tiny manufacturing plants, etc.). □

## PROGRESS REPORTS

### NBRI Annual Report: 1988-89

The National Botanical Research Institute (NBRI), Lucknow, investigated, during 1988-89, thirty-one projects — six pertaining to fundamental research and 25 to applied research.

In the area of Taxonomy and Ethnobotany, 555 plant species used variously by the inhabiting ethnic groups and primitive tribes of Uttar Pradesh and Madhya Pradesh, were collected. Preliminary chemical screening of 7 of the ethnomedicinal plants showed significant anti-fertility activity in experimental hamsters, the maximum (90%) in the tuber of *Dioscorea daemonia* Roxb. and the minimum (50%) in the root of *Vanda tessellata* Hook. ex. G. Don and the gum of *Sterculia urens* Roxb. Also, seeds of *Nyctanthes arbor-tristis* Linn. showed anti-leishmanial, hepato-protective and immuno-stimulant activities.

A study on the seed development in 10 species of *Vicia* showed that the seeds are devoid of endosperm tissue and the embryo itself is the main organ of storage. The pattern of endosperm haustoria in a number of *Euphorbia* species reflected evolutionary trends in the various tribes of Euphorbiaceae.

The taxonomic and morphological studies brought to light 12 species of lichens, 7 of *Pyrenula*, 4 of *Peltula*, and 1 of *Heppia* as new records from India.

Anti-microbial testing of essential oils from various species of *Artemisia* against pathogenic bacteria showed that 8 of these were active against *Klebsiella pneumoniae*, 7 against *Staphylococcus aureus*, 6 against *Pseudomonas aeruginosa*, 5 against *Streptococcus faecalis* and 4 against *Escherichia coli*. However, oils from only five species were found effective against human pathogenic fungi, 2 against *Aspergillus fumigatus* and 3 against *Candida albicans*, but to a lesser extent. Besides, 2 species of *Leucas* also exhibited anti-microbial activities.

Saponin, isolated from *Madhuca butyracea* McBride seeds, was made at par with the imported

saponin used by the Hindustan Photofilm Manufacturing Company, Ootacamund. Xanthotoxin from *Ammi majus* L. was found to be as effective as streptocycline against the casual organisms of leaf-spot and footrot diseases of betelvine.

Early flowering, within 70-80 days, was induced in opium poppy, as against 105 days in normal lines, with a comparable capsule size of 16.18 cm<sup>2</sup>. The morphine content in straw was comparable to high morphine straw lines from the western countries.

The red colouring matter was isolated from the inflorescences of *Amaranthus caudatus* L. and *Celosia* sp. Identified as betacyanin, it can be used in deserts, ice creams and beverages. The vegetable colour from *Woodfordia* was standardized.

Chemical investigation of indigenous tannin-bearing plants revealed that *Bergenia ligulata* Engler and *Mimusops littoris* contained 15% and 16% tannins, respectively. Various constituents of these tannins were isolated and identified.

Agronomical studies on the improvement of betelvine cultivation confirmed that neem cake applied at 100 kgN/ha gave a high yield (5840 kg/ha, fresh wt) of leaves. At 150 kg N/ha, the neem cake not only increased the keeping quality of leaves by 4-5 days over the ones kept as control, but also brought about a reduction in the intensity of foot- and leaf-rot diseases.

Genetic upgrading studies carried out on *Amaranthus* revealed that F<sub>1</sub> hybrids, involving temperature dependent male sterile line with 3 other lines of *A. hypochondriacus* L. gave 1.4-4.0 times higher per plant grain yield.

Cytological investigations of the available germplasm of guayule was carried out for its genetic improvement. As among a diploid (2n=36) cv. USS2X, a triploid

( $2n=54$ ) cv. Cal 1, and a hypotetraploid ( $2n=66$ ) cv. A. 11591, the first named cultivar was considered significant because of the possibility of its use for breeding purposes. A single solvent rubber extraction method was also developed.

A cost-effective cropping pattern was evolved for reclamation and management of 'Usar' land at Aligarh. Also, 4.2 tonnes (dry wt) of flowers of *Chamomilla recutita* L. were produced on 5 ha. Among the trees on usar soils treated with gypsum, the maximum (12.05 t/ha) above ground biomass was estimated for *Prosopis juliflora* (Siv.) DC. in a 3-year old plantation.

Under the Drug Standardization Research Unit of CCRUM, 6 single herbal drugs and 7 Unani formulations were standardized. Under another project of CCRUM, 60 species were documented out of the 213 being maintained in the herbal garden, 50 species being annual. Also, 266 drug samples and 1500 herbarium specimens were incorporated in the drug museum.

A multidisciplinary approach in the area of Floriculture led to the development of 9 new ornamental cultivars which were under various stages of assessment before their release as new cultivars. Of these, 4 belonged to *Chrysanthemum* 'Himanshu' — which blooms twice a year in October-November and April-May, a new rosy pompon flowered seedling blooming in February-March, a new yellow coloured mutant of cv. 'Khumaini', and a gamma-ray induced mutant 'Navneet' bearing small decorative type pansy-violet flowers; one belonged to *Gladiolus* — a new hybrid with beautiful colour combination having 16-20 flowers on a long spike, 6-8 opening at a time; and 4 to *Hippeastrum* — all new hybrids with attractive flower colour combinations.

The protocols for rapid clonal multiplication through tissue culture were standardized for *Rosa hybrida* 'super star', *Peperomia obtusifolia* A. Diels. and *Chlorophytum comosum* Baker.

Forty gladiolus cultivars were found to be having various degree of mild to severe viral symptoms. Five of these were discovered to be infected with BYMS.

Induction of gladiolus cormlets in tissue culture for virus-free plantlets was achieved in 3 cultivars. Besides a collar rot and leaf spot disease, several storage diseases of corms of gladiolus were also detected and studied.

Four plants, having attractive flowers, viz. *Heteropteris syriacaefolia*, *Ruellia formosa* Ander, *Abelmoschus manihot* L., *Medic* and *Dianthes deltoides* L., introduced by the Institute, have performed very well over past few years. These were being multiplied for release to the nursery trade. Eight ornamental annuals, introduced earlier, namely *Calendula macroeana*, *C. arvensis*, *C. suffruticosa* Vabl., *Anthemis arvensis* Bonkhob, *Scabiosa atropurpurea* L., *S. calambosis* ssp. *calambosis*, *S. rhodopensis* and *Daucus muricatus* L. proved their merit to be included in the ornamental wealth of India.

The ability of *Ceratophyllum demersum* L. to withstand chromium up to 0.1 ppm (WHO recommended limit: 0.05 ppm) and its capacity to accumulate chromium up to a great extent (867  $\mu\text{g/g}$  dry wt) suggested its usefulness for the assessment and abatement of the water quality, especially polluted with chromium. Likewise, the usefulness of *Glaucocystis nostochinearum* Itzigsohn and *Hydrodictyon reticulatum* L. in monitoring  $\text{Cr}^{6+}$  pollution was also demonstrated. Studies under a technology mission project on biological water purification showed that at Kalyani Devi Pond

in Unnao district, *Spirodela* could accumulate Pb ( $1690 \mu\text{g g}^{-1}$  dry wt), Cu ( $148 \mu\text{g g}^{-1}$  dry wt) and Cd ( $50 \mu\text{g g}^{-1}$  dry wt), while *Ceratophyllum* accumulated manganese ( $6324 \mu\text{g g}^{-1}$  dry wt) and *Azolla* accumulated Mn ( $6650 \mu\text{g g}^{-1}$  dry wt). Through water treatability studies, the effectiveness of *C. demersum* and *H. reticulatum* in removal of both Cr and Cd was also demonstrated.

While studying the process of photosynthesis and nitrogen metabolism in plants, the low light grown and high light grown cultures of *Spirulina platensis* (Gom.) Geitler were characterized with respect to their pigment composition and electron transport activity. The high light grown alga was found to be more resistant to photo inhibition and had a higher capacity to recover; the repairing mechanism in both the cultures was operational during photo inhibitory process. Thus, the photo inhibition was clearly demonstrated to be the net result of a balance between the rate of damage and its repair by *de novo* protein synthesis. The specific activity of NADH-NR of the purified preparation from *Amaranthus* leaves was demonstrated to be comparable to the homogeneous NR preparations from other plant sources. The molecular weight of the native enzyme was determined to be 230,000 daltons with 2 identical subunits of MW 110,000 and one lower having MW 13,000. The studies carried out on the effect of chemical modification of histidyl residues using diethyl pyrocarbonate (DEP) on plant mitochondrial electron transport showed that DEP inhibits flow of electrons from NADH to oxygen, and that histidine residue modification leads to inhibition of electron transport from ubiquinone to cytochrome b. Further studies on photosynthetic characteristics of *Populus deltoides* Marsh. revealed that the tempera-

ture maxima of photosynthesis varied with seasons, being maximum (30°C) in summers and minimum (20°C) in autumn.

The kinetics of ammonium transport was studied under different physiological conditions in *Nostoc muscorum* Ag. and *Anabaena cylindrica* Lemm., and a biphasic pattern of ammonium uptake was discovered; the first phase was rapid and passive, while the second phase was slow and dependent on *in vivo* assimilation through GS. The ammonium uptake in *N. muscorum* revealed two transport system — the high affinity ( $K_m$  7.04  $\mu$ M) and low affinity ( $K_m$  285.7  $\mu$ M) — as against one ( $K_m$  33.34  $\mu$ M) in *A. cylindrica*.

The studies on tissue culture of economic plants were continued and a large number of *in vitro* raised plants of 3 important bamboo species, viz. *Dendrocalamus strictus* Nees., *Bamboosa balcooa* Roxb. and *Thyrsostachys oliveri* Gamble were successfully transferred to soil and grown under glasshouse conditions, and a few grown in normal as well substandard soil. Likewise, *in vitro* raised plants of *Populus deltoidea* Marsh. Clone G-48, *Saccharum officinarum* L., *Rauwolfia serpentina*, and *Solanum khasianum* Clarke were successfully grown in field. Also, a protocol for induction of microtubers of cultures of senescing shoots of *Solanum tuberosum* L. was standardized; an average number of 10 microtubers were formed per culture within 60 days.

The four national facilities, viz. Banthra Research Station, Economic Botany Information Service, Botanic Garden and Herbarium continued to offer specialized services in their respective areas of activity.

Seventy-six research papers were published during the year and 66 presented at the various symposia, seminars and conferences. Twenty-four popular science/

semi-technical articles were also published. □

## TRAINING COURSES

### Integrated Training Programme for Trainers under CSIR Action Plan on Low-cost Building Materials & Housing

The title training programme was held at the Gramin Bhawan Nirman Kendra, Lucknow, during 10-13 December 1990. It was organized by the Central Building Research Institute (CBRI), Roorkee, in collaboration with CSIR Headquarters, New Delhi, CRRI-New Delhi, SERC-Ghaziabad, HUDCO, U.P. Gramin Avas Parishad, COSTFORD-Trichur, HSMI and Avas Vikas Sansthan (Jaipur). The 88 persons who attended the programme included Chief Development Officers from Meerut, Rae Bareilly, Gonda, Azamgarh, Agra, Jhansi, Hardoi and Lucknow. Other participants were from IRDWS, Koreput; Technical Teachers Training Institute, Chandigarh; U.P. Jal Nigam; Regional Institutes of Rural Development at Badaun, Ghazipur, Jhansi, Gorakhpur and Haldwani; Rural Engineering Services, U.P.; U.P. Avas Vikas Parishad; U.P. State Electricity Board; U.P. Rural Housing Board; U.P. Rural Development and Research Institute; U.P. PWD; K.G.N.S. Raipur; Government College of Architecture, Lucknow; Municipal Corporations; HUDCO; and Avas Vikas Sansthan, Jaipur. The participants for the course included administrators, engineers, architects, entrepreneurs, voluntary workers, block development officers, lecturers and students.

The programme comprised lectures and demonstrations pertaining to low-cost building materials and construction techniques. The lectures covered innovative build-

ing techniques for rural areas; rural sanitation and environment; new alternative materials for building construction; entrepreneurship development in production of innovative building materials; rat-trap bond and filler slab, ferrocement in low-cost construction and rural roads. The demonstrations arranged related to: non-erodable mud plaster; plinth protection of mud walls; fire retardant thatch roof; waste water disposal system, rural latrine, stabilized mud blocks/bricks; technologies of partially precast roofing system, L-pan, RC tinted cum chhajjas; RC plank, brick panel, channel units; ferrocement roofs; and water tanks. The audio visual presentations were also made.

A full-scale model of rural hut was constructed, depicting the technologies of plinth protection, non-erodable mud plaster, frameless door and windows and fire-retardant thatch roof along with rural latrine and waste water disposal system.

Also a special session was held in which the following participated: Smt. Sukhda Misra, Minister, Rural Development, U.P. Government; Shri S.K. Sharma, CMD, HUDCO, New Delhi; Dr V. K. Saxena, Principal Secretary & Agriculture Production Commissioner, U.P. Government; Shri Ashtana, Jt. Secretary, Ministry of Rural Development, Government of India; Dr S. K. Misra, Director, CBRI; Shri A. Matee, Managing Director, A. V. S. Jaipur; Shri Laurie Baker, Director, SIRD, Lucknow; Ms Aradhana Johry, Special Secretary & Commissioner, Rural Housing Board, U.P. and Shri A.K. Gupta, Secretary, Rural Development, U.P. Government.

In the exhibition, about 50 charts and models of waste water disposal system, low-cost latrine, brick tiles for roofing and flooring, and fire retardant thatch were displayed.

Towards the end of the training programme, a proposal was made to adopt one village in each of the five regions of U.P., where all houses could be constructed demonstrating the low-cost building materials and techniques.

It was felt that there is an immediate necessity to launch the programme on a much bigger scale to make its impact felt at the national level. □

### **Training Course on Modern Tools in Immunobiology**

A training course on Modern Tools in Immunobiology, sponsored by the Department of Biotechnology, was held at the Industrial Toxicology Research Centre (ITRC), Lucknow, during 15-30 January 1991.

The objective of the course was to acquaint the young scientists and research workers with the various modern techniques used in immunobiological research by giving hand to hand exercises and demonstrations conducted by eminent immunologists of national and international repute. The course covered: General principles and techniques in immunobiology, Parameters of assaying humoral and cell-mediated immunity, Mitogen-mediated stimulation of lymphocytes, Antigen-antibody interaction, HLA typing, Lymphokine assay and NK cell assay. About 25 lectures were delivered during the course.

Research workers from various institutes, viz. National Institute of Virology (NIV), Pune; National Institute of Occupational Health (NIOH), Ahmedabad; AmIa Cancer Research Centre (ACRC), Trichur; Mahatma Gandhi Institute of Medical Sciences (MGIMS), Wardha; Calcutta University; King George Medical College (K GMC), Lucknow; Sanjay Gandhi Post-Graduate Institute of Medical Sciences



Participants of the training course being explained the modern techniques used in immunobiological research

(SGPGIMS), Lucknow; Central Drug Research Institute (CDRI), Lucknow; and ITRC participated in the course.

Faculty for the course was drawn from the Cancer Research Institute (CRI), Bombay; All India Institute of Medical Sciences (AIIMS), New Delhi; National Institute of Immunology (NII), New Delhi; KGMC; SGPGIMS and ITRC.

Presiding over the inaugural function, Prof. P.K. Ray, Director, ITRC, said that there was a need to develop proper immuno-diagnostic techniques for early detection of diseases and disorders. He stressed the need to develop less toxic and more potent immunogenic vaccines against infectious diseases and parasitic disorders. He informed that advanced research was being conducted in the country in the following areas: immunological approach to birth control, cancer treatment, and toxicity reduction, production of various immuno-

diagnostic kits and development of elisa assays.

Dr Nitya Nand, former Director, CDRI, Lucknow, in his inaugural address said that the immunology has acquired an important position in the field of biomedical research and it has a number of applications in the field of health and disease. Use of immuno-modulators in the treatment of immuno-deficiency diseases and auto-immune disorders is an advanced area of research. The work being carried out at ITRC in the field of immuno-modulators is significant for better understanding of immuno-toxicity caused by drugs and chemicals, he added.

Prof. S.S. Agarwal, Professor and Head, Genetic Department, SGPGIMS, in his guest lecture said that modern immunobiology has come at the stage of molecular immunology and recent researches have been based on the techniques used in modern molecular biology.

Prof. Agarwal said that there is a need for development of modern

techniques for better understanding of the vast subject of immunology. Emphasis should be laid on its application in human health and disease. He said that extended vaccination programme is the need of the country, for providing health and safety to our population. □

### **Mangrove Familiarization Course for Forest Officials**

A five-day Mangrove Familiarization Course for Forest and Social Forestry Officials of the Government of Maharashtra was organized at the National Institute of Oceanography, Goa, during 28 January - 1 February 1991. The programme, sponsored by the Government of Maharashtra, was held with a view to creating awareness among the foresters about significant ecological role played by mangrove ecosystem along the coastline. Attended by 23 forest officials, the course covered aspects such as structure and function of mangroves, phytogeographical distribution, remote sensing and other survey techniques, ecological characteristics, captive and culture fisheries, afforestation, conservation and management, wildlife and legislative aspects of mangrove ecosystem. The participants also visited the plantation sites of Forest Departments at Chorao (Goa) and Aronda (Maharashtra).

At the concluding session, the participants opined that there was an urgent need to legally conserve the mangrove areas with immediate effect, set up mangrove nurseries and initiate a large scale mangrove afforestation programme. They suggested that such familiarization, orientation and refresher courses should be organized at regular intervals, in view of the ecological significance of mangroves, and stressed the need

for creating awareness among the masses through various media.

### **Intensive Course on Dosing of Fluids**

The Design & Engineering Division of Indian Institute of Chemical Technology (IICT), Hyderabad, organized a two-day Intensive Course on Dosing of Fluids, on 3-4 January 1991. The objective of the course was to initiate R&D activity in the area of Apparatus & Chemical Machinery at the institute with full involvement of user and manufacturing industry, academic institutes, engineering consultants and national laboratories.



Prof. G. Vetter addressing the participants of Intensive Course on Dosing of Fluids

Prof. Gerhard Vetter, formerly Technical Managing Director of M/s Lewa Pumps, famous throughout the world for their equipment on dosing and metering systems, and presently Dean in the School for Apparatus & Chemical Machinery at the University of Erlangen, FRG, was the Course Director. Dr A.V. Rama Rao, Director, IICT, presided over the inaugural function and welcomed the Chief Guest, Dr D. Swaminadhan, Member, Planning Commission, Government of India, and the delegates. Shri R.N. Parlikar,

Deputy Director and Head, Design & Engineering Division, IICT, briefed the audience about the aims and objectives of the course, and introduced the Course Director, Prof. Vetter.

Dr Swaminadhan, in his inaugural address stressed the necessity to bring the industrial research institutions and academic institutes closer, in order to optimize the utilization of available human and financial resources. Shri G.V. Yugandhar, Assistant Director, Design & Engineering Division, IICT, proposed a vote of thanks.

About fifty delegates from consultancy organizations, research institutes, manufacturing and fabrication units, and including the turn-key contractors and pump manufacturers attended the course.

The course covered the following topics: Dosing — An Over View, Fundamentals of Fluid Dosing, Fluid Dosing Systems, Fluid Dosing with Reciprocating Metering Pumps, Design and Properties for Plunger and Diaphragm Pumps, Fluid Dosing with Rotary Metering Pumps and System Selection, Installation Designs and Fluid Dosing Applications. □

### **CBRI Extension Centre, New Delhi, participates in New Cost-effective Building Materials and Workmen's Tools Exhibition**

The CBRI Extension Centre, New Delhi, participated in the Indian Railways Exhibition, organized by the Institution of Permanent Way Engineers — India Northern Centre, New Delhi, at the Railway Officers Club, on 13 February 1991.

The exhibition was inaugurated by Shri Y.P. Anand, Member, Engineering, Railway Board; Shri S.M. Vaish, General Manager, Northern Railway,

presided over the inaugural function. About 42 manufacturing firms of Building Materials put up their stalls in this exhibition. The CBRI display included charts and technical literature on bricks from fly ash, bricks from red soil, cellular concrete blocks from fly ash, manufacture of country tiles, lightweight polymer concrete, sandwich type composite door panels, calcium silicate bricks, gypsum binder/boards, ferrocement door shutters, fire protection for thatch roof and paints used for fire protection of shamanas and curtains. Samples of sand-lime bricks, clay-fly ash bricks, fly ash-sand-lime bricks and gypsum board were also put up. A 3-page write-up on these topics was distributed to the visitors. About 400 delegates and other persons visited the stall. This was the first such exhibition organized by the Railways on such a large scale. It was decided to organize such exhibitions on a continuing basis. □

### CDRI holds Children-Scientists Meet

The Central Drug Research Institute (CDRI), Lucknow, organized a 'Children Meet-Scientists' programme on 21 February 1991. The programme was sponsored by the National Council of Educational Research and Training (NCERT). Students of 10 local colleges participated in this meet. Dr V.P. Kamboj, Deputy Director, CDRI, welcomed the students and briefed them on the institute's activities. Five scientists from the institute spoke on the various stages of drug development, modern information technology, role of biopolymers in drug research, application of gene cloning in pharmaceuticals and research and development efforts in population control. The students were taken round the various laboratories of the institute. At the end of the programme a 'Science

Quiz' was organized in which children took active part. Winners of the 'Science Quiz' were given awards. □

### PATENTS FILED

1070/DEL/90: An improved process for the preparation of antimalarial drug arteether from artemisinin (qinghaosu). R.A. Vishwakarma, R.S. Thakur, G.P. Dutta, R. Bajpai — Central Institute of Medicinal and Aromatic Plants, Lucknow.

1071/DEL/90: An improved process for the production of antimalarial drug artemisinin (qinghaosu) from the plant *Artemisia annua*, A.P. Kahol, P. Hazra, R.S. Bhakuni, R.S. Thakur, K.K. Aggarwal, R.A. Vishwakarma and D.C. Jain — Central Institute of Medicinal and Aromatic Plants, Lucknow.

1076/DEL/90: A process for the preparation of biocide useful for controlling mosquito borne diseases from *Bacillus sphaericus*. M.C. Bhatia, P.D. Trivedi, S.C. Tripathi, G.P. Dutta, V.P. Sharma, V. Bihari, S.K. Basu and B.N. Dhawan — Central Drug Research Institute, Lucknow.

1077/DEL/90: A process for the synthesis of 5-acyl-2-acylamino-1H-benzimidazoles useful as antifilarial agents, V. Ojha, J. Singh, D.S. Bhakuni, S.N. Singh, A. Dutta and R.K. Chatterjee — Central Drug Research Institute, Lucknow.

1078/DEL/90: A process for the synthesis of alkyl 5(6) - [(N<sup>1</sup>, N<sup>3</sup>-dicarbalkoxyguanidino) phenyl] carbonylbenzimidazole-2-carbamates, V. Ojha, J. Singh, D.S. Bhakuni, S.N. Singh, A. Dutta and R.K. Chatterjee — Central Drug Research Institute, Lucknow.

1079/DEL/90: A process for the preparation of 3-arylmethyl-1-(3'-diethylaminopropyl) pyrrolidines, D. De, M., Seth, S.K. Puri, S.

Chandra and A.P. Bhaduri — Central Drug Research Institute, Lucknow.

1080/DEL/90: An improved method for the preparation of cyclohexanone azine, cyclohexanone oxime simultaneously using zirconium containing zeolite catalyst, P.P. Moghe, P. Ratnasamy, M.K. Dongare, A.V. Pol, M.G. Kotasthane, S.S. Biswas, A.S. Tambe and P.K. Bahrat — National Chemical Laboratory, Pune.

1082/DEL90: An improved process for the manufacture of optically active alpha-aryl propionic acids, U.K. Joshi, H.R. Sonawane and N.R. Ayyangar — National Chemical Laboratory, Pune.

884/DEL/90: An improved process for preparation of α-bromodiethyl carbonate, D.P. Sahu and S.K. Chatterjee — Central Drug Research Institute, Lucknow.

885/DEL/90: An improved process for the preparation of bacampicillin, D.P. Sahu and S.K. Chatterjee — Central Drug Research Institute, Lucknow.

886/DEL/90: An improved process for the isolation of swerchirin (1,8-dihydroxy, 3,5-dimethoxy xanthone) from the plant *Swerdia chirayita*, M.B. Bajpai, B. Chandrasekhar, B. Mukherjee, S.K. Mathur, R.K. Asthana, S.K. Palvi, R.B. Chakravarty, A.K. Sengupta, R. Banerjee, N.K. Sharma, B.N. Mehrotra, D.K. Kulshreshtha, S.K. Nigam, S.K. Chatterjee and S.K. Mukherjee — Central Drug Research Institute, Lucknow.

888/DEL/90: An electric control device for uninterrupted supply of conventional and non-conventional (solar) electric energy wherever such supply is required, P.K. Ray, P.K. Seth, J.W. Bhattacharjee (British), V.K. Sehgal, R.K. Sharma, R. Gopal, S.K. Srivastava, S.P. Pathak and S. Kumar — Industrial Toxicology Research Centre, Lucknow. □



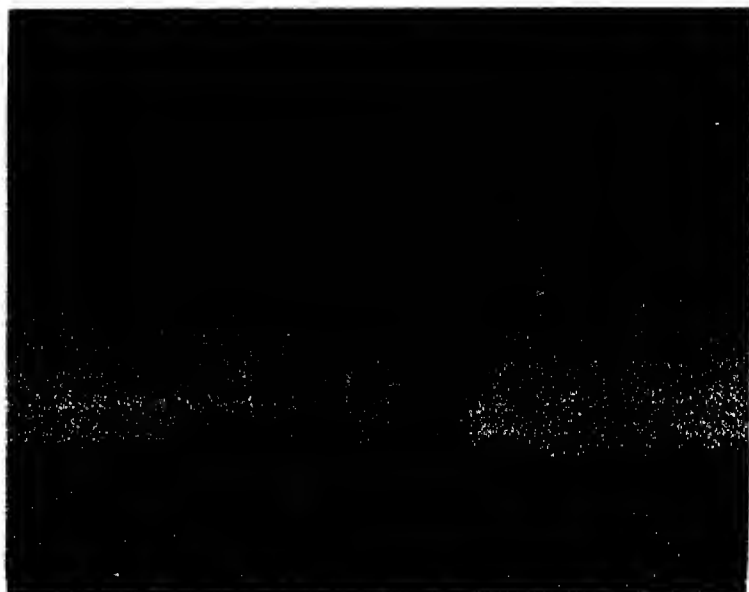
# CSIR NEWS



A SEMI-MONTHLY

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Clock-wise from top left: Full scale blast load test on an aircraft pen structure designed by SERC-Madras, Testing of a 440 kV switchyard structure, and Flexural test on slurry infiltrated fibre concrete specimen at SERC. A summary of significant R&D activities of the laboratory during 1989-90 appears on p.108

## Third International Symposium on Beneficiation and Agglomeration — ISBA-91

The third International Symposium on Beneficiation and Agglomeration (ISBA-91) was held at Bhubaneswar, from 16 to 18 January 1991 under the joint auspices of the Regional Research Laboratory, Bhubaneswar and the Indian Institute of Metals, Bhubaneswar Chapter.

The symposium was inaugurated by the Chief Minister of Orissa, Shri Biju Patnaik. In his inaugural address, Shri Patnaik stressed that the R&D organizations in the country should be engaged in activities which could be implemented for improving the working conditions of the village folks. He also emphasized that the country should have its own indigenously designed equipment for setting up plants instead of depending on other countries.

Earlier, welcoming the delegates and other participants, Prof H.S. Ray, Chairman, ISBA-91 and Director, Regional Research Laboratory, Bhubaneswar, highlighted the R&D activities of his laboratory in the areas of mineral processing and extractive metallurgy. He said that the laboratory has a team of dedicated scientists whose expertise and experience would continue to be available for the industrial development of this region as well as the country as a whole for decades to come.

Dr J.J. Irani, Jt. Managing Director, Tata Steel, Jamshedpur, who was the Chief Speaker on the occasion, expressed his views on making scientific research more fruitful and productive. He said that scientific research is a prerequisite for the progress and prosperity of any country and India's industrial base could be strengthened through increased productivity, effective utilization of material and manpower resources

and application of up to date scientific and managerial methods. He also added that the selection process for research projects should be carefully structured so as to eliminate any inconsistency and bias and there should be a perfect blend of human relations aspect and the scientific aspect of management to maximize the efficiency.

Dr A.P. Mitra, the then Director General, CSIR, in his presidential address spoke about the achievements of CSIR laboratories.

Shri J.C. Nayak, Vice Chairman of the Indian Institute of Metals, Bhubaneswar Chapter, introduced the foreign delegates and read out messages conveyed by important dignitaries wishing success to the symposium. Shri D.N. Dey, Convener, ISBA-91, proposed a vote of thanks.

More than 230 delegates participated in the symposium, which included a large number of overseas delegates from countries like Germany, China, Iran, The Netherlands, Brazil, Canada and USA.

The inaugural function was followed by two special lectures delivered by Dr S.K. Gupta, Managing Director, Rourkela Steel Plant and Dr R.K. Iyengar, Additional Director General, CSIR. Dr Gupta spoke on the problems and prospects of sintering process in the iron and steel industry, with special reference to Rourkela Steel Plant, while Dr Iyengar presented an overview on beneficiation of nickel-bearing laterite ores and high ash coals.

In all, 85 papers were presented in eighteen sessions devoted to 'Beneficiation' and 'Agglomeration'. The papers covered a wide area involving beneficiation and agglomeration of

minerals and coal. Some of the topics covered related to modelling of oxidation reaction of magnetite in a pellet; modelling of chromite sintering process; use of expert systems in flow sheet simulation of beach sand beneficiation; beneficiation of high ash content coal blends; bio-beneficiation of limestone; use of ferritic cement as binder for agglomeration of iron ore; testing methods for ores and agglomerates; new improved methods for sintering which would reduce gas consumption, increase the productivity and improve the sinter quality; new developments in Jones wet high intensity separators; methods for beneficiation of low grade hematite, graphite and copper ores; improved methods of briquetting; studies on reduction of iron ore using CO/coal as reductant; recovery of low grade sheelite fines from gold tailings, and utilization of blue dust in extended arc plasma reactor for obtaining white cast iron.

In the final recommendation of the symposium, it was stressed that in order to develop proper strategy for judicious utilization of the mineral resources including coal, there should be closer interaction among the mine owners, user industries, planning units of both state and central governments, as well as the researchers in the field of mineral utilization.

The symposium concluded with profound appreciation of the efforts of both the Regional Research Laboratory, Bhubaneswar and the Indian Institute of Metals, Bhubaneswar Chapter, for holding the symposium on a topic of great national importance at regular intervals, and with emphasis on the need for holding these symposia in future also. □

## Indo-British Workshop on Industrial Energy Conservation

A three-day Indo-British Workshop on Industrial Energy Conservation was held at the National Chemical Laboratory (NCL), Pune, during 6-8 February 1991. It was organized under a joint project between NCL, Pune and the University of Salford, UK. The project was sponsored by the British Overseas Development Administration and administered by the British Deputy High Commission, British Council Division, Bombay. The workshop was inaugurated by Mr H.K. Firodia, Chairman, Kinetic Engineering Ltd, Pune. Dr V.M. Nadkarni, Head, Chemical Engineering Division, NCL, welcomed the gathering.

Dr R.A. Mashelkar, Director, NCL, in his introductory remarks on this topical issue of industrial energy conservation, emphasized that we should look at conservation from a global viewpoint and plan our strategies to conserve everything 'from soil to oil'. Speaking about the NCL's effort, he cited the process development for kerosene from the abundantly available natural gas. He pointed out that the approach of NCL is pro-active rather than being reactive. About the use of energy in the industrial sector, he regretted that most people tend to use the high grade energy where low grade energy would suffice. He suggested that good housekeeping practices with process optimization and control would help conserve energy significantly. NCL is concentrating on the process energy demand management, Dr Mashelkar added.

Prof. F.A. Holland, Department of Chemical and Gas Engineering, University of Salford, gave an account of the various activities under the NCL/Salford collaborative programme during 1982-91.

Although, the collaboration would come to an end soon, he was enthusiastic about the new energy projects with which NCL would be involved, such as alternatives to CFCs and industrial scale demonstration of mechanical vapour re-compression assisted ethanol distillation in an Indian distillery.

Mr H.K. Firodia, Chairman, Kinetic Engineering Ltd, Pune, in his inaugural address emphasized the need to develop not only the technologies relevant to current needs but also be ready with some appropriate technologies for the future. Although these may not be economical today but these would be helpful when there is a more drastic or real energy crisis. He also advocated that India, having developed a strong technology base through technology absorption, should now strive to be competitive in the world market. This can only be achieved by being conscious about the cost inputs of raw materials including energy costs which hitherto have been very much neglected. On the use of non-conventional energy sources, he suggested the development and use of solid fuels like hydrides for the automotive industry, which are completely combustible and pollution free.

The workshop was attended by about sixty participants from more than forty industrial organizations including distilleries, refineries, chemical and petrochemical industries, and project engineering and energy consultants.

The following lectures were delivered: 'Advanced Absorption Cycles for Energy Saving and Environmental Protection' and 'Absorption Systems in Germany' (Prof. G. Alefeld, Tech. Univ. of Munich, Germany); 'New Energy

Technologies in Food Industry' and 'Heat Transformers in Industrial Processes' (Prof. T. Berntsson, Chalmers University of Technology, Sweden); 'Field Experience with Absorption Cooling' (Dr R. Best, UNAM, Mexico); 'Energy Conservation in Chemical and Process Industries' and 'Energy Conservation in Evaporation' (Dr S. Devotta, NCL); 'Industrial Energy Audit — Basic Concepts' and 'Industrial Energy Audit — Practicality and Ensuring Meaningful Results for your Company' (Mr M.R. Fry, W.S. Atkins Energy, UK); 'Utilization of Low Grade Heat at IIE' (Mr H. Fernandez, IIE, Mexico); 'Applications of Steam Compression' and 'Combined Heat and Power in Industry' (Dr A.V. Heaton, Electricity Research & Development Centre, Capenhurst, UK); 'Drying with Energy Recovery' and 'Heat Pump Assisted Distillation' (Dr D.L. Hodgett, Electricity Research & Development Centre, Capenhurst, UK); 'Heat Pump Fundamentals' and 'Economics of Energy Conservation Technologies' (Prof. F.A. Holland, University of Salford, UK); 'Preliminary Design of Heat Pumps' and 'Heat Exchanger Networks and Energy Conservation' (Dr V.S. Patwardhan, NCL); 'Absorption Heat Pumps' (Prof. I.E. Smith, Cranfield Institute of Technology, UK).

Also, representatives from IDBI, ICICI and MCCI made presentations on their programmes on energy conservation. A panel discussion was held at the end of workshop. The workshop also included the demonstration of two heat pump units at NCL. □

## CSIR-DAAD Symposium on Biosciences

The German Academic Exchange Service (DAAD), in co-operation with CSIR and the Council's laboratories in Lucknow, viz. Central Drug Research Institute



During the CSIR DAAD Symposium on Biosciences, seen on dais (from left) are Dr Ram K Iyengar, Additional Director General, CSIR, Dr Theodor Berchem, President, DAAD, Mr J B C Hoffman, Director, DAAD and Prof B N Dhawan, Director, CDRI

(CDRI), Central Institute of Medicinal and Aromatic Plants (CIMAP), Industrial Toxicology Research Centre (ITRC) and National Botanical Research Institute (NBRI), organized a three-day Symposium on Biosciences, at CDRI during 15-18 November 1990. About 60 DAAD and 15 Humboldt grantees from CSIR institutes all over the country participated.

The German delegation led by Dr Theodor Berchem, President, DAAD, Bonn, included Prof. Hermann P.T. Ammon, Prof. J.K. Reichert and Prof. Karl-Heinz Scheit from Germany; Dr Richard Giesen, Consul General of Germany in Calcutta; Dr Ekkehard Abel, Counsellor (Science & Technology), Embassy of the Federal Republic of Germany, New Delhi and Mr J.B.G. Hoffmann, Mrs Rupa Batra-Israel and Mr K. Hariharan of the DAAD's New Delhi Office.

Inaugurating the symposium, Dr Ram K. Iyengar, Additional Director General of CSIR, emphasized that an integrated holistic approach of various sciences to the problem of health was needed for the well-being of the society. He defined health as a multidimensional phenomenon involving in-

terdependent physical, physiological and social aspects. He also stressed the need of health education and health policies which should be pursued simultaneously and in close co-ordination.

Addressing the gathering, Prof. Berchem emphasized that the Indo-German Exchange Programme reflected the high priority which Germany accorded to India in its foreign policy. He lauded the highly satisfactory partnership with CSIR and expressed the hope that the relationship will continue to be strengthened.

Following lectures were delivered during the symposium: 'Where do we stand with respect to malaria control?' by Prof. V. Ramalingaswamy; 'Chances of gene technology' by Prof. Scheit; 'Global climate change — issues for the developing countries' by Prof. S.K. Sinha; 'Methods for pharmacological testing of medicinal plants: *In vitro* screening for antiphlogistic activity' by Prof. Ammon; 'Hepatoprotective activity of some Indian medicinal plants' by Prof. Dhawan; 'Application of pesticides and plant treatment agents in FRG, consequences for the drinking water supply, possible methods of water purification,

analysis in the ng/l range by Prof. Reichert; 'Environmental pollution vis-a-vis Indian scenario' by Dr P.K. Ray; 'Man and nature—past, present and future' by Dr T.N. Khoshoo. A panel discussion on Recent trends in biosciences, a poster session and a visit to various laboratories were also organized. □

## India and Australia sign MoU on S&T Cooperation between CSIR and DITAC

Dr S.K. Joshi, Secretary, Department of Scientific & Industrial Research and Director General, CSIR, and Mr David W. Evans, High Commissioner of Australia in India, signed a Memorandum of Understanding on cooperation in science and technology between the Council of Scientific & Industrial Research (CSIR), India and the Department of Industry, Technology and Commerce (DITAC), Australia, on 19 April 1991. The agreement is a direct result of the visit to Australia by the former Minister of Science, Shri K.R. Narayanan in 1988 and the subsequent visit to India by the Minister for Industry, Technology and Commerce, Senator John Button in 1989. The high level Australian delegation was led by the Chief Science Adviser to DITAC, Prof. Michael Pitman, and included senior scientists from Government and private sector research and development institutions.

During the ten days following the signing, members of the Australian delegation visited a number of CSIR institutions such as the Centre for Cellular and Microbial Biology in Hyderabad, the National Chemical Laboratory in Pune, the National Aeronautical Laboratory in Bangalore and the National Institute of Oceanography in Goa. They also visited other important scientific institutions in-



10. *Journal of the American Medical Association*, 2000; 283: 2686-2692.

Prof. S.K. Joshi, FNA, Chairman Organizing Committee and the then Director of NPL (presently Director General, CSIR), in his welcome address mentioned that Dr Ambedkar's long-cherished dream has not yet been fulfilled. He emphasized the need to chalk out concrete and action-oriented programmes to assuage the sufferings of the millions.

Shri K.R. Narayanan, former Minister of State for Science and Technology, in his presidential address while describing Baba Saheb's contributions towards social, economic and political developments in India said that Dr B.R. Ambedkar, a scholar and intellectual giant, was kindled by revolutionary urge for the transformation of the age-old unequal social structure of India. Dr Ambedkar's ideas and methods have become all the more valid today for the fight against social inequality and injustice, Shri Narayanan added.

Dr K.I. Vasu, former Director, CECRI, Karaikudi, in his key-note address analyzed the essence of Ambedkarism and the spectrum of activities of Baba Saheb. Dr Vasu said that while many of his contemporaries tried to build an image of internationalism around them, Dr Ambedkar, even with knowledge in

fields as diverse as law, economics, politics, sociology, anthropology, history, religion and philosophy, remained a down-to-earth nationalist of the highest order, and advocated for social transformation towards egalitarianism and fought for a just society throughout his life. Ambedkarism is essentially the synergism of nationalism, patriotism and democracy based on the concept of liberty, equality and fraternity, Dr Vasu added.

Dr G.P. Phondke, Director, PID, spoke on the necessity and mode of taking science to the people in the remotest corner of the country to give them the benefit of science for their overall upliftment. Dr Ashok Jain, Director, NISTADS, gave a talk on 'Science in Society and Inequalities'.

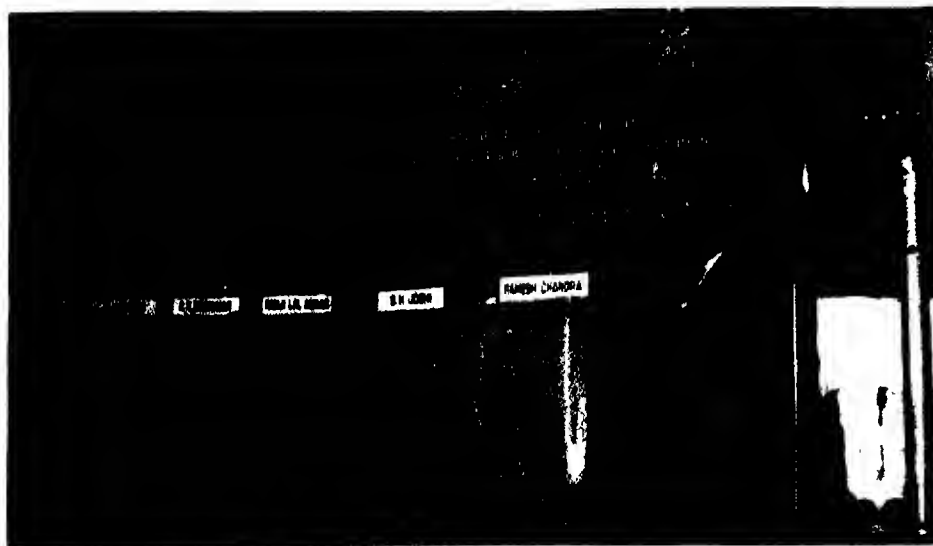
Chairing the valedictory function, Shri Dasai Chaudhary, Union Minister of State for Health & Family Welfare and Deputy Minister for Industries, threw light on Dr Ambedkar's thoughts and approach to the problems, and emphasized the role of science and scientists in the development of society free from all types of social and economic exploitation. He also stressed the need for more active participation of scientists in planning the future plan activities of the nation.

In his concluding remarks, Dr N.G. Uke emphasized the need for effective education programmes and propagation of scientific thinking in the society. He called for shedding all orthodox rituals, practices and other unscientific activities being practised in the Indian society. □

## Workshop on Modern Methods of Chemical Analysis for Minerals & Metals

A three-day workshop on Modern Methods of Chemical Analysis for Minerals & Metals was organized by the Analytical Chemistry Division of the National Metallurgical Laboratory (NML), Jamshedpur, during 22-24 January 1991. Fifty delegates from a number of organizations such as National Thermal Power Corporation, Indian Oil Corporation, Hindustan Copper Ltd, Larsen & Tubro, Indian Bureau of Mines, Raurkela Steel Plant, Durgapur Steel Plant, Research & Development Centre for Iron & Steel (Steel Authority of India Ltd), Uranium Corporation of India Ltd, Tata Iron & Steel Co., Tata Engineering & Locomotive Co., Indian Cable Co. and others attended the workshop.

The main objective of the workshop was to provide an opportunity for analysts, material scientists, engineers and technologists to acquaint themselves with the new trends in analysis. The thrust of the workshop was on: Introducing the theory and practice of modern methods of chemical analysis, Imparting knowledge for the application of these techniques to a range of typical problem areas, Giving an in-depth knowledge of analysis for ferrous and non-ferrous metals and alloys, Developing an understanding for the analysis of ores and minerals during beneficiation, and Hands-on prac-



Shri Ramji Lal Suman inaugurating the National Seminar on Dr Ambedkar, Science and Society





Dr L.P. Pandey addressing the participants of the Workshop on Modern Methods of Chemical Analysis for Minerals & Metals. Seated on the dais (from left) are Prof. S. Banerjee and Dr S.C. Srivastava

tice in both instrumentation and chemical methods.

Prof. S. Banerjee, Director, NML, inaugurated the workshop and Dr S.C. Srivastava, Head, Instrumental Analysis Section, welcomed the participants. In his address on the occasion, Prof. Banerjee termed speedy and accurate analytical work as the 'backbone' of any research and quality assurance programme. Far from adding to costs, timely analysis could contribute to savings. For example, if hot metal could be instantaneously analyzed before pouring, entire lots of castings/forgings could be of prime quality. Thus he stressed the importance of efficient and accurate constituent analysis as a direct tool for increasing the productivity and quality in metallurgical and chemical industries.

Dr L.P. Pandey, Head, Analytical Chemistry Division, in his introductory speech, emphasized on the importance of analytical chemistry as an integral part of any metallurgical/engineering project. In fact profitability depended on quality control. Besides, all new technological developments must be employed in chemical laboratories and these techniques

must be dispersed in various organizations with alacrity, hence the need for such a workshop.

Shri K.K. Gupta, proposed the vote of thanks.

The delegates were given hands on experience in laboratory techniques. Detailed discussions were held on: (i) X-Ray Fluorescence Spectrophotometry for Minerals and Metals Analysis, (ii) Atomic Absorption Spectrophotometry, (iii) Inductively coupled Plasma Spectrometry, (iv) Complexometric Titrations, with special reference to silicate analysis, and (v) UV-Vis Spectrophotometry. □

### Mechanistic Aspects of Controlled Release Delivery System based on Hydrogels

Amongst the various types of controlled release delivery systems, the matrix systems are generally preferred because of the ease of fabrication, low-cost and amenability to manufacture on large scale. Unfortunately, the release rate of the active ingredient of the matrix device decreases with time. A number of approaches have been proposed in the past to achieve zero order release which is

the preferred release profile in pharmaceutical dosage forms. However, the work so far has been focussed essentially on systems in which the active ingredient is physically dispersed.

Shri S.S. Shah, while working at the National Chemical Laboratory (NCL), Pune, studied the elucidation of the factors which govern the kinetics of the release of active ingredient from the glassy and swollen hydrogels. A number of substituted benzoic acids were esterified with 2-hydroxyethyl methacrylate to yield the corresponding ester monomer. The monomer was then copolymerized with HEMA and the kinetics of release from the glassy hydrogels in alkaline medium were investigated.

It was shown that depending on the relative rates of hydrolysis, the penetration of the medium, and the diffusivity of the active ingredient released by hydrolysis, a wide range of release profiles can be realized. Specifically, the release of *p*-nitrobenzoic acid was found to be controlled by the rate of penetration of the medium. It was shown for the first time that the release of an active ingredient chemically linked to the polymer back-bone via pendent chain was released at constant rates. The investigation also provided experimental validation of the models proposed in the literature. The release of *p*-nitrobenzoic acid was extended up to 14 h.

In order to design delivery systems which would release the active ingredient over extended time periods up to a few months, hydrophobic polymers containing larger proportions of *p*-nitrobenzoic acid were prepared. Although the release of *p*-nitrobenzoic acid from such matrices followed zero order kinetics, it could not be attributed to the penetration of the alkaline medium.

This was further confirmed from the fact that the release of

*p*-nitrobenzoic acid from equilibrium swollen hydrogels followed zero order kinetics. This was subsequently explained on the basis of the concept of time dependent diffusion coefficient of *p*-nitrobenzoic acid, as a result of increase in the hydrophilicity of the polymer consequent on the release of *p*-nitrobenzoic acid itself. The work demonstrated that it is possible to achieve the release of active ingredient at constant rates even from rubbery hydrogels. The work was subsequently extended to the systems which can release the active ingredient at constant rates for periods up to five months.

This work highlights newer concepts to achieve release of active ingredients at constant rates from matrix systems based on glassy as well as swollen hydrogels and can be exploited to design matrix systems for the release of drugs of pragmatic importance over time periods of clinical significance.

Shri Shah carried out the above work under the guidance of Dr R.A. Mashelkar, and he was awarded Ph.D. degree by the Poona University for his thesis based on these studies. He was awarded first prize for the best presentation of a paper at the 4th National Conference of the Society for Biomaterials and Artificial Organs India, at Hyderabad. He is now working with AmGen Inc., USA, with Dr C.G. Pitt, one of the leading authorities on controlled release delivery systems based on biodegradable polymers. □

## PROGRESS REPORTS

### SERC-Madras Annual Report 1989-90

The Structural Engineering Research Centre (SERC), Madras, pursued during 1989-90, 23 R&D projects; of these four were sponsored assignments. Seventeen consultancy assignments were taken up and completed. The develop-

ment of 'expert systems' for structural engineering applications continued to be one of the thrust areas of the Centre. A knowledge-based expert system for synthesis and design of transmission line towers was developed and was being validated. This software can run on a personal computer and is intended to help design engineers in government departments, electricity boards, and private industries to develop optimum design of towers. An expert system for the design of communication towers and another for preliminary design of hyperbolic cooling towers were being developed. The number of licensees using SERC software packages increased from 130 to 184 during the year.

Recognizing the potential of parallel processing in computer-aided analysis and design of structures, the Centre initiated the development of software in this area by using a multi-processor computer acquired for this purpose.

Research investigations on blast-resistant design of structures were continued. Computer software was developed to assess and analyze transient dynamic response of structures subjected to blast loading. The new projects sponsored by the Research Development Establishment (Engrs.), DRDO, Ministry of Defence, were taken up.

The Centre continued to be associated with the UNCHS/ USSR/ GOI project on: Transfer of Technology on Building Materials and Components for Developing Countries. At a meeting held in Riga, USSR, in September 1989, preliminary technology profiles on technologies useful to developing countries, prepared by SERC/CBRI and other CSIR laboratories on behalf of Government of India, and those prepared by LBRI (Latvian Building Research Institute, Riga) were dis-

cussed. Based on these discussions, a combined report on technology was brought out in December 1989.

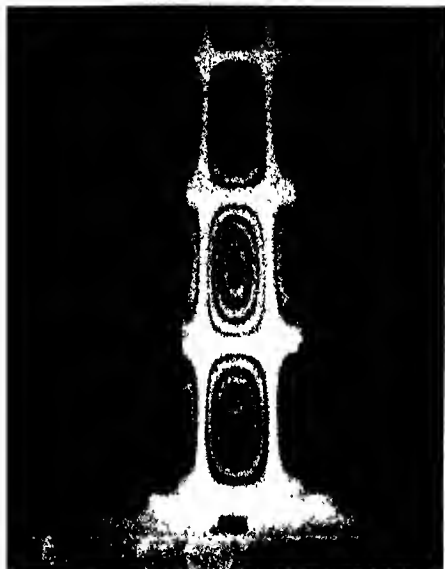
SERC participated in a unique full-scale testing of an aircraft pen structure earlier designed by the Centre. The pen structure was subjected to blasts and missile penetration loading and the Centre carried out extensive field measurements on various parameters influencing the behaviour and stability. These test results helped improve the design further.

Analytical and experimental investigations were initiated to understand the structural behaviour of framed machine foundations. This work is partly sponsored by the National Thermal Power Corporation.

The Tower Testing and Research Station of SERC achieved a unique record in testing for the first time in the country, a 500 kV slim line tower designed and fabricated by M/s Locweld Inc., Canada, for the user agency M/s Ontario Hydro, Canada. A 400 kV guyed tower was also tested for Indian industry.

Studies were being carried out on stress concentration of stiffened tubular joints used in offshore structures and on crack propagation characteristics in T and Y joints. The fracture mechanics approach essential for understanding the crack growth phenomenon leading to failure was being adopted for interpretation of fatigue crack observations obtained from a large number of tests.

The reliability of the various available test methods for field monitoring of corrosion of steel in reinforced concrete structures was being assessed by conducting both laboratory and field experiments. Further studies were made on damage assessment, repairs, and rehabilitation of distressed structures. Suitable methods were developed for casting high volume



Vibration studies on a conical shell model (chimney) by holography

fibre concrete. Studies were also initiated to understand the impact resistance characteristics of structural members made of such high volume fibre concrete.

Experimental techniques were developed for measuring residual strain by combining the sandwich holography technique with the blind-hole drilling method. Possibility of using resistance wire strain gauges for measurement of strains beyond elastic stage was investigated. Vibration studies on shell models by holographic interferometry were extended to two conical shells. An optical bench set-up was used to study caustic fringes for measuring the stress concentration around a hole in a plate. Experimental investigations on structural components for projects *Trishul* and *Agni* were completed.

In the field of ship structures, development of an interactive graphics program for finite element modelling of ship hull structures was nearing completion.

During the year, SERC scientists published 18 papers in journals, and presented 47 papers at conferences/symposia. □

## NGRI Annual Report: 1989-90

The R&D programmes of the National Geophysical Research Institute (NGRI), Hyderabad, are grouped under the following broad areas: (1) Lithospheric Studies, (2) Exploration Geophysics, and (3) Environmental Geophysics. A brief account of the significant achievements of the institute during 1989-90 is presented here:

The institute continued the Oil & Natural Gas Commission supported field operations for deep seismic sounding (DSS) in the West Bengal basin, along two profiles, Taki-Arambhagh (120 km, EW) and Bishnupur-Kandi (95 km, NS) with a short geophone spacing of 80m. In addition to normal refraction and wide angle reflection surveys, a 30 km CDP profile with 120 channel spread and 60 fold stacking was taken up. Preliminary analysis of the data pertaining to these profiles was carried out. Analysis of DSS data on profiles from Beliatar to Bongaon and from Gopali to Port Canning showed basement depths of 10-11 km at the eastern ends and Moho depths varying from 25 to 30 km. Furthermore, density modelling of the Cambay basin and the Godavari graben and determination of the velocity structure of the North Cambay basin were also carried out. Gravity modelling was done for three DSS profiles by using the DSS results as constraints for interpretation.

The magnetotelluric (MT) instrument built at NGRI was coupled to a personal computer and some processing and interpretation software was implemented on the system.

A first order basement depth map was prepared for a part of the Saurashtra region by using information derived from MT data acquired under a programme supported by OIDB. Two very long profiles involving 48 MT field sta-

tions were also made in the Saurashtra region.

About 7200 line-km of aeromagnetic data were collected in a survey sponsored by OIL. The survey covered parts of Upper Assam and Arunachal Pradesh. With this survey, NGRI has completed the entire valley lying between the Naga hills on one side and the Arunachal hills on the other, which has a rich oil potential. Preliminary analysis of the data collected during the year showed that the depth of magnetic basement around Brahmaputra river is about 5-7 km.

With the helium sniffer facility developed earlier, a survey was carried out over a gas-bearing structure in the Jaisalmer basin, Rajasthan. Samples were collected at a depth of 1.6 m from about 150 stations. The results show a zone of abnormally high helium values. Whether these abnormal values are also related to the presence of hydrocarbons would make an interesting study in search of a method of locating hydrocarbon deposits.

The network of seismological observatories in the NE region continued to operate and collect valuable data under the NGRI-RRL (Jorhat) programme. A total number of 973 events of magnitude ranging from 3-4.5 were recorded during the calendar year 1989. The rise in frequency of earthquake occurrence in this region, which was registered in 1986, appears to be continuing. There is a conspicuous NS alignment of epicentres of shallow events across the Brahmaputra valley in the region between Hamren in Assam and Bomdila in Arunachal Pradesh. An NE-SW oriented rectangular area of 150 km X 100 km size around Jorhat continues to be devoid of significant seismic activity.

Geohydrological and geophysical studies were carried out in 283 problem villages in Andhra

Pradesh, Jammu & Kashmir, Kerala, Orissa, Rajasthan, Tamil Nadu and Uttar Pradesh for locating suitable sites for drilling of boreholes. Geoelectric soundings were carried out at 659 locations in these villages and 264 sites were recommended for drilling of wells. Out of these, 136 were actually drilled by the concerned agencies, and data available for 71 of these boreholes have shown more than 90% success.

Geoelectric soundings done in Barmer district in Rajasthan for delineation of deeper aquifer zones resulted in finding deep fresh water aquifers at Rowtra and Malte-ka-Talla.

Work on the augmentation of groundwater resources of overexploited aquifers through artificial recharge was undertaken in the Jani river basin in Nagpur district. The capacity for intake of water under gravity was measured in three boreholes, the specific intake capacities of different depth zones being determined by using packers for isolating different sections. Hydrofracturing of these holes at appropriate depths would be undertaken during the next year. This activity would provide parameters for the determination of effectiveness of the method as well as the design of surface systems, such as check dams, for artificial recharge.

The new building for the Cyber 180/850A computer was inaugurated on 14 June 1989. The installation of the computer continued for a large part of the year and testing of various subsystems was in progress. Installation of a network system to connect other small computers and terminals located in different places in the laboratory buildings was also in progress. This computer system would go a long way in establishing the application and use of computerized problem solving, large volume data processing and efficient storage and retrieval of a

variety of information bases as a culture.

The construction of H-maser clock was undertaken by the National Physical Laboratory, one of the partners in the programme on establishment of geodetic VLBI capability in India. Action for the establishment of a 25m radiotelescope began with the decision that the VLBI facility would be fully funded by CSIR. Negotiations for training abroad were also started.

The first major campaign intended to be carried out with the Geodetic VLBI Telescope would be aimed at the determination of rates of change of baselines with the Indian station at one end, and stations on the surrounding tectonic plates at the other end of these lines.

During the year, a sum of Rs 25.5 million was received from the sponsors of various programmes at NGRI.

## Honours & Awards

### Om Prakash Bhasin Awards for Dr R.A. Mashelkar, Dr B.N. Dhawan and Dr Joytirmoy Das

Dr R.A. Mashelkar, Director, National Chemical Laboratory (NCL), Pune; Dr B.N. Dhawan, Director, Central Drug Research Institute (CDRI), Lucknow; and Dr Joytirmoy Das, Scientist, Indian Institute of Chemical Biology (IICB), Calcutta, have been awarded the prestigious 'Shri Om Prakash Bhasin Awards for Science & Technology' for the year 1990. Instituted by Shri Om Prakash Bhasin Foundation, New Delhi, these awards are being given annually since 1985, for significant contributions of a pure or applied nature or outstanding scientific leadership in various fields of S&T. The work should have made, or has the potential to make, a significant impact on national development, or bring renown to the country. Each

award carries a cash prize of Rs 50,000, a memento and a citation.

### Dr R.A. Mashelkar

Dr Mashelkar gets the award for his outstanding contributions in the field of Engineering and Technology. He is internationally known for his work in polymer science and engineering in which field he has published more than 150 papers. He has also edited more than 14 books. He has contributed significantly to Indian industry both individually and through the Polymer and Engineering Group established at NCL under his leadership. The group comprises some of the best talent available in the country and has developed several polymers for use in engineering, agriculture, oil fields, etc. Some of these (like *Jal shakti*, a superabsorbing polymer) have been commercialized, and others are at various stages of development, testing and commercialization. He has carried out modelling and simulation of industrial processes for polyester fibre, the melt spinning of PET and the polyacrylonitrile fibre precursor. Some of the software developed by him have been used in Japan, France and USA.

During the last three months, Dr Mashelkar has been honoured with Padma Shri, has been nominated as the President of Physical Sciences Section of the National Academy of Sciences and appointed a member of the Central Pollution Control Board by the Government of India.

Dr Mashelkar's contribution as an Assessor in the Inquiry Commission that investigated the Bhopal gas leak disaster, as a member of the Science Advisory Council to the Prime Minister during 1988-90, etc. are well known.

### **Dr B.N. Dhawan**

Dr Dhawan gets the award in the field of Health and Medicine. He has carried out pioneering research work in the following areas: (i) role of biogenic amines in regulating central nervous system activity and demonstration of the receptor types involved, and (ii) evaluation of suitable strategies for exploitation of medicinal plants and optimization of leads obtained for therapeutic purposes.

Prof. Dhawan initiated his studies on the role of biogenic amines in the regulation of CNS activity in 1957. He has carried out extensive investigations to delineate the role of catecholamines (including dopamine), 5-hydroxytryptamine and histamine in thermoregulation, central cardiovascular control, analgesia, stereotyped behavior, regulation of blood brain barrier and motoneurone activity. Prof. Dhawan has used sensitive neurophysiological techniques including microiontophoresis, radioligand binding assays, etc. for analyzing neurotransmitter/drug effects at cellular level. Further, to rule out the possibilities of interspecies variation in results, several species of animals have been used in most cases.

Prof. Dhawan has been intimately involved in systematic studies on medicinal plants since 1956. He has utilized several approaches to optimise lead generation, including broad based biological screening, specialized pharmacological studies on carefully selected plants used in traditional system of medicine for specific diseases like liver disorders, filaria and bronchial asthma.

The initial clinical studies have been followed by laboratory evaluation. The results of this multi-pronged approach were very rewarding and several new plant products are under clinical and preclinical development.

### **Dr Joytirmoy Das**

Dr Das has been awarded for his outstanding contributions in the field of Biotechnology. His research interest is primarily in genetics and molecular biology of prokaryotic cells in general and pathogenic organisms in particular. He developed the molecular biology of mycoplasmas, the smallest free living organisms and their viruses. His present interest is in understanding the molecular basis of pathogenicity of *Vibrio cholerae*. Included in the studies carried out by him are: (i) an analysis of the structure, growth pattern and molecular details of replication of cholera phages under permissive and non-permissive conditions; (ii) delineation of the steps involved in the repair of DNA damage in the vibrio; (iii) investigation on the cell surface and membrane proteins; and (iv) the mechanism of toxin synthesis and secretion. Dr Das has developed the infrastructure for genetic engineering research at IICB. This laboratory is now considered one of the best for studies on molecular biology and genetics of prokaryotic cells in this country.

Dr Das has also made significant contribution to modelling of biological process from kinetic and thermodynamic view-points. His work on the criteria determining the existence of non-equilibrium steady states in composite reaction systems, particularly those involving cyclic reactions need special mention. He proposed: (i) a macroscopic model for cell lysis from the analysis of membrane transport and internal entropy production and (ii) that the selection rule is more permissive and the probability of multiple mechanisms is higher in case of cyclic reactions enhancing the fidelity of reactions in presence of random environmental error variables, and established conditions for near equilibrium instabilities in

chemical systems under non-ideal conditions. □

### **Dr Ganesh Pandey and Dr K.N. Ganesh win the B.M. Birla National Science Awards for 1990**

Dr Ganesh Pandey of the Indian Institute of Chemical Technology, Hyderabad and Dr K.N. Ganesh of the National Chemical Laboratory, Pune, have won the B.M. Birla National Science Awards (1990) for young scientists in the field of Chemistry. Each award carries Rs 25,000 in cash and a certificate.

### **FIE Foundation Award for three NCL Scientists**

Dr A.F. Mascarenhas, Dr (Smt) R.S. Nadgauda and Smt. V.A. Parasharami, Scientists, Biochemical Sciences Division, National Chemical Laboratory (NCL), Pune, have been selected for the FIE Foundation Award for the year 1991 for their outstanding contributions to Biochemical Science. The collective award carries a cash prize of Rs 25,000.

Dr Mascarenhas, Head of the Plant Tissue Culture Laboratory at NCL, is an eminent scientist in the area of plant tissue culture. He has carried out pioneering work on the development of techniques for micropropagation of a wide range of plants and trees.

The NCL tissue culture team headed by Dr Mascarenhas and comprising Dr (Smt) Nadgauda and Smt. Parasharami besides himself, achieved a first-ever breakthrough in the tissue culturing of bamboo, which has won international acclaim. The technique, for the first time, makes it possible for bamboo plants to flower within weeks against several years taken by plants that grow wild or that are grown by conventional methods. They achieved this by growing seedlings from tissues in a special culture medium containing a plant

growth regulator and nutrients [CSIR News, 40 (1990) 106]. □

### Research Papers by IIP Scientists win Awards

The paper entitled 'Characterization of heavy alkylated benzenes by GC-MS technique' (authors: Basant Kumar, H.C. Chandola, R.B. Gupta and Pradeep Kumar of Indian Institute of Petroleum, Dehra Dun), was adjudged best paper in the poster (PE) session of the Fifth National Symposium on Mass Spectrometry, held at PRL, Ahmedabad, during 7-9 January 1991.

The paper entitled 'Studies on microbial dewaxing of petroleum fractions' (authors: V.S. Saini and V.R. Sista of IIP, and N.M. Surana, N. Subrahmanyam of M.S. University, Vadodara) won the best presentation award in the Biochemical Engineering and Biotechnology session of the Indian Chemical Engineering Congress 1990, held at BHU, Varanasi, during 18-21 December 1990.

### Prof. D. Guptasarma

Prof. D. Guptasarma, Director, National Geophysical Research Institute (NGRI), Hyderabad, has been elected President of the Indian Geophysical Union for the period 1991-93. □

### PATENTS FILED

887/DEL/90: An improved process for the preparation of 4-phenyl-1-(2-substituted ethyl)imidazolidin-2-ones, S. Batra, S. Sharma, V. Nigam, S. Gupta, P.Y. Guru, J.C. Katiyar — Central Drug Research Institute, Lucknow.

1081/DEL/90: An improved integrated two-step process for conversion of methane to liquid hydrocarbons of gasoline range, V.R. Choudhary, S.D. Sansare and S.T. Chaudhari — National Chemical Laboratory, Pune.

1182/DEL/90: An improved process for the extraction of nickel, copper and cobalt from manganese sea nodules, A.K. Saha, Z.H. Khan and D.D. Akerkar — National Metallurgical Laboratory, Jamshedpur.

1183/DEL/90: An improved process of heat treatment for magnesium alloys, R.K. Dubey, S.C. Dev, R.K. Mahanti, C.S. Sivaramakrishnan — National Metallurgical Laboratory, Jamshedpur.

1200/DEL/90: Improvements in or relating to the synthesis of various forms of polyaniline, S.K. Dhawan and D.C. Trivedi — Central Electrochemical Research Institute, Karaikudi.

1201/DEL/90: A process for the deposition of conducting polyaniline on insulating surfaces, D.C. Trivedi and S.K. Dhawan — Central Electrochemical Research Institute, Karaikudi.

1202/DEL/90: A process for the preparation of polymeric composition of polyaniline for electrostatic charge dissipation, conducting filler material and as conductive adhesive, D.C. Trivedi and S.K. Dhawan — Central Electrochemical Research Institute, Karaikudi.

1097/DEL/90: An improved process for the production of cyclohexanone and cyclohexanol, J.S. Reddy, S. Sivasanker and P. Ratnasamy — National Chemical Laboratory, Pune.

1098/DEL/90: An improved process for the manufacture of E-caprolactam from cyclohexane, A. Thangaraj, S. Sivasanker and P. Ratnasamy — National Chemical Laboratory, Pune.

1099/DEL/90: An improved process for the manufacture of E-caprolactam from cyclohexane, J.S. Reddy, S. Sivasanker and P. Ratnasamy — National Chemical Laboratory, Pune.

1100/DEL/90: An improved process for the production of cyclohexanone and cyclohexanol, A. Thangaraj, S. Sivasanker and P. Ratnasamy — National Chemical Laboratory, Pune.

1101/DEL/90: An improved process for the manufacture of E-caprolactam, J.S. Reddy, S. Sivasanker and P. Ratnasamy — National Chemical Laboratory, Pune.

1123/DEL/90: A process for the preparation of titanium rich crystalline microporous titanium silicas, A. Thangaraj, R. Kumar, P. Ratnasamy — National Chemical Laboratory, Pune.

1124/DEL/90: A process for the preparation of an active composition containing triterpenes including azadirachtin and its derivatives possessing insect antifeedant and growth inhibitory activity from parts of the neem plant, B.A. Nagasampagi, S.R. Rojekar, M.M. Kulkarni, V.S. Joshi, V.S. Bhat, M.G. Sane and N.R. Ayyangar — National Chemical Laboratory, Pune.

1125/DEL/90: A process for the preparation of new insecticidally active composition containing lipids from the parts of the neem tree, B.A. Nagasampagi, M.M. Kulkarni, S.R. Rojekar and N.R. Ayyangar — National Chemical Laboratory, Pune.

1126/DEL/90: A process for the isolation of new triterpene derivatives of azadirachtin from the parts of neem tree, B.A. Nagasampagi, S.R. Rojekar, M.M. Kulkarni and N.R. Ayyangar — National Chemical Laboratory, Pune.

1203/DEL/90: A process for the production of Fe-Mn-Al alloys for relay core applications, C. Tewari, S. Pramanik, V. Rao and O.N. Mohanty — National Metallurgical Laboratory, Jamshedpur. □



# CSIR NEWS



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## IN THIS ISSUE

CSIR Technology Awards — 1990 presented	116
Indo-German Seminar on Electrochemistry	117
Flame-proof PAN Fibres	117
ONGC design Consultancy Assign- ment to CSIR Engineering Ser- vices Division	118
BHEL (Bhopal), RRL (Bhopal) and PWL take up project on development of fibreglass rein- forced plastic material for gear cases	118
CSMCRI-HSL agreement for installa- tion of indigenous potash plant at Kharaghoda	119
Demonstration of RRL-Bhopal's Bell Metal technology to village artisans	119
CIMAP Annual Report. 1989-90	121
CFB Annual Report 1989-90	122

A close-up view of fermentation pilot plant (top) and pipe network and cell homogenizer of pilot plant for ethanol production from molasses at Biochemical Engineering Research and Development Centre at IMTECH (p114)

# Biochemical Engineering Research and Process Development Centre at IMTECH

Funded jointly by the Department of Biotechnology and the Council of Scientific & Industrial Research, the Biochemical Engineering Research and Process Development Centre (BERPDC), a national facility, has a wide variety of laboratory scale and pilot plant equipment to study biochemical reactions, separation techniques, and process control and optimization parameters. Although established formally in 1986, the Centre was allotted a permanent location in August 1989, which it shares with other research groups of the Institute of Microbial Technology (IMTECH), Chandigarh.

The main objectives of BERPDC are:

(i) To enable researchers from universities and other research centres to use the scale-up facilities for process development.

(ii) To undertake sponsored projects for the development of new products and/or new technologies.

(iii) To do basic research on the development of biochemical processes, encompassing modelling, analysis, control and process optimization.

(iv) To evaluate technologies proposed to be imported or upgraded by either private or public sector industries.

(v) To train technical personnel from industry as well as universities and research institutions in advanced biochemical engineering techniques.

(vi) To collaborate with various industries and research centres in terms of scientific and technical information exchange and the optimal use of different equipment.

The major facilities available at the Centre include : (i) Laboratory scale fermenters having capacities varying from 0.5 to 20 litres, with classical or computer control; (ii)

Fully computerized pilot scale fermenters of 150 litre and 1500 litre capacities, (iii) Animal cell culture fermenters, (iv) Air-lift fermenters, (v) Tangential flow ultrafiltration system, (vi) Refrigerated centrifuge, (vii) Mass spectrometric gas analyzer, (viii) Membrane filtration modules, (ix) Cell disintegrator, (x) High pressure cell homogenizer, (xi) Gas-liquid chromatograph, (xii) CHN analyzer, (xiii) CO<sub>2</sub> incubator and (xiv) Freeze drier. The following facilities are planned to be added during 1990-95: (i) Basket centrifuge, (ii) Pilot scale membrane filtration, (iii) Filter presses and rotary vacuum filter, (iv) Evaporator-cum-crystallizer, (v) Spray drier, (vi) Solvent extractor, (vii) Autoanalyzer and (viii) Pilot scale distillation unit.

## Research Projects Accomplished/Planned

(i) *Ethanol production from molasses*: An improved strain of *Saccharomyces cerevisiae* has been developed for the fermentation of molasses to ethanol. This strain has superior characteristics in terms of higher sugar and alcohol tolerance compared to commonly used commercial strains and produces higher yields of ethanol. The process technology up to the pilot plant level has been transferred to an industry-associated R&D organization for the development of a commercial scale process.

(ii) *Biotransformation of Rifamycin B to S*: A fungal strain has been isolated which under optimal conditions produces the enzyme rifamycin oxidase. This enzyme has been used to transform rifamycin B to S in a one-step process which has some advantages over the conventional chemical methods of transformation. The IMTECH strain has been

assigned to a public sector drug company.

(iii) *Streptokinase: Strain improvement and Process development*: Streptokinase is used in the treatment of myocardial infarction, where it scores over tissue type plasminogen activator and urokinase in the ease of manufacture, specificity of proteolytic activity and longer clearance time. In India, the enzyme is imported and formulated into therapeutic doses. IMTECH's preliminary studies with a *Streptococcus* sp. have attracted the attention of several industrial concerns. The complete project involves strain improvement to commercially viable levels and optimisation of a laboratory scale fermentation process.

(iv) *Fermentative separations of biochemicals*: Liquid membrane emulsions offer a novel and promising technique of combining fermentation with product recovery. To enable upscaling of laboratory technology, it is necessary to address to a number of fundamental problems related to: membrane stability, *in situ* rates of mass transport and membrane swelling, droplet size distributions, product separation, and design-oriented models. Under this project a study on these aspects would be made to develop technology for a multi-enzyme system producing L-leucine, L-isoleucine and L-valine.

A number of new research activities are being planned to be taken up. These include:

(i) *Design, scale-up and dynamics of bioreactors*: It is proposed to study kinetics, mass transfer, heat transfer, fluid dynamics and cell metabolism for different kinds of bioreactors. From these, fundamental design and scale-up methodologies will be developed for industrial applica-



A view of 150-litre fermenter assembly with central control computer in the background



CHN analyzer with accessories at BERPDC

tions. The next phase will be the mathematical analysis of bioreactors under non-equilibrium conditions such as start-up and during process disturbances. Two specific problems which will be addressed are : (a) coupled chemostats sustaining oscillating biochemical reactors, and (b) hollow fibre reactors for mammalian cell culture.

(ii) *Novel separation methods:* New strategies are required for the recovery of microfractions of high value biochemicals like streptokinase and monoclonal antibodies. Novel techniques such as liquid membrane emulsion and affinity partitioning are being explored and will be applied to IMTECH's projects. The tech-

nologies will also be made available to external users.

(iii) *Mammalian cell culture technology:* BERPDC will soon venture into this difficult but vital area. A few promising hybridoma cell lines producing antifibrin monoclonal antibody have been developed. Large-scale production of these antibodies in hollow fibre reactors is planned. To evolve a commercially viable technology, the studies will focus on cell viability in different environments, mixing characteristics, gas-liquid and liquid-solid mass transfers, and the effects of shear.

#### **Interaction with Other Organizations**

The Centre has research or educational links with the following organizations: National Chemical Laboratory, Pune; University of Poona, Pune; Panjab University, Chandigarh; Indian Institute of Technology, Delhi; Central Food Technological Research Institute, Mysore and Indian Institute of Technology, Kharagpur. Several staff members and students of these organizations have availed the Centre's facilities. Scientists of BERPDC participate in the teaching programmes of Panjab University. A post-M.Sc. diploma course in Biotechnology has been started from the academic year 1989-90 in collaboration with the Centre for Biotechnology, Panjab University.

Within IMTECH's framework BERPDC encourages and sponsors its staff to participate in training and educational programmes within and outside the country. These include registering for doctoral programmes and attending conferences and workshops. These facilities are an integral part of BERPDC's continuing commitment to maintain its staff at the frontiers of biochemical engineering research.

Being a national facility, the BERPDC welcomes users from in-

dustry, academia and research organizations to use its facilities and expertise. Since BERPDC is part of IMTECH, other facilities in the institute are also available for sponsored research.

## CSIR Technology Awards - 1990 presented

CSIR instituted in 1990, two sets of technology awards to recognize and encourage technology development and multidisciplinary team efforts of CSIR scientists/institutes. These awards, given annually, are: CSIR Shield for Technology and CSIR Technology Prizes.

The awards for 1990 were presented by Prof. M.M. Sharma, FRS, Bhatnagar Fellow, on 29 April 1991, at a function held in New Delhi, to the following institutions/scientists:

### CSIR SHIELD FOR TECHNOLOGY

1. *Shield for Engineering Technology* was awarded to the National Aeronautical Laboratory (NAL), Bangalore, for its outstanding contributions to aerospace engineering especially to the national aerospace projects involving development of combat aircraft, missiles, satellites and launch vehicles. The laboratory has through inhouse effort established contemporary R&D facilities for fatigue and fracture testing, for acoustic tests on satellites, and for fabrication and testing of composites, as also trisonic and dynamic simulation wind tunnels, water tunnels, parallel computers, etc., and achieved high level of expertise in mathematical modelling in fluid and solid mechanics, in the science and technology of composites, and in fatigue and fracture of aerospace materials and structures.

These developments and efforts of NAL have greatly contributed to

For details, please contact: Dr P.R. Patnaik, IMTECH, P.O. Box 1304, Sector 39-A, Chandigarh - 160 014.

achieving self-reliance in the aerospace field.

2. *Shield for Process Technology* was awarded to the Indian Institute of Chemical Technology (IICT), Hyderabad, for its sustained development of technology for agrochemicals which has enabled indigenous production of several pesticides hitherto imported. Besides creating an impressive industrial impact, the technology has fetched CSIR handsome amounts as royalties and licence fees.

The technology developed from basic stage, in most cases involved innovative process routes suited to Indian conditions, basic and detailed engineering design and assistance in commissioning, as also formulation know-how and pesticides registration data.

### CSIR TECHNOLOGY PRIZES

1. *Prize for Chemical Technology* was jointly awarded to the groups at Indian Institute of Petroleum, Dehra Dun, and National Chemical Laboratory, Pune.

The group at Indian Institute of Petroleum, Dehra Dun, comprising Dr B.S. Rawat and S/Shri S.K. Gupta, J.M. Nagpal, P.C. Gupta and Guru Prasad was awarded the prize for its development of a process for extraction of pure aromatics from naphtha streams using sulpholane as solvent - a totally indigenous solvent extraction technology. The process being successfully used by the petroleum industry has not only helped the country in saving foreign exchange by averting import of pure aromatics but the import of technology as well.

The group at the National Chemical Laboratory, Pune, comprising Drs P. Ratnasamy, B.S. Rao, I. Balakrishnan, V.P. Shiralkar, and A.N. Kotasthane was awarded for its innovative development of encillites - a series of zeolite catalysts. Encillites have exceptional catalytic activity for several industrially important processes such as production of *para*-xylene, ethylbenzene, olefins, etc. The development of the catalysts and the associated process know-how has enabled the evolution of several novel, internationally competitive technologies.

2. *Prize for Engineering Technology* was awarded to the group at the National Aeronautical Laboratory, Bangalore, comprising Drs K.N. Raju, P. Sunder, P.K. Dash, K. Anandan and Shri M.C. Venkatesh, for its contributions to advances in fatigue and fracture mechanics as applied to the aerospace field. The group among other notable achievements carried out fatigue life evaluation of airframe of fighter aircraft using indigenously developed servo-hydraulic multiactuator full scale fatigue testing facility, resulting in structural modifications for improved airworthiness, generation of crucial data and extended life. In addition, the group has developed novel techniques for fatigue crack growth testing, crack closure stress determination and crack growth prediction.

3. *Prize for Materials Technology* was jointly awarded to the groups at Central Electrochemical Research Institute, Karaikudi and National Physical Laboratory, New Delhi.

The group at Central Electrochemical Research Institute, Karaikudi, comprising initially Drs H.V.K. Udupa, R. Thangappan, and S/Shri S. Krishnamurthy, P. Subbiah, B.R. Yadav and presently Drs K. Asokan, K.

Subramanian and Shri V. Arumugam was awarded the prize for its timely development of technology for titanium substrate insoluble anodes (TSIA). This development helped India to break the world monopoly on technology of a multinational corporation. The wide-spread usage of TSIA in chlor-alkali and allied electrochemical industries has resulted in substantial energy saving for the country.

The group at NPL, comprising Drs O.P. Bahl, L.M. Manocha, G.Bhatia, T.L. Dhami and R.K. Aggarwal, was awarded for its development of technology for manufacture of high density carbon-carbon composites including development of multi-directional carbon fibre weaving process. This technology is of strategic importance due to the usage of carbon-carbon composites in Indian Missile Programme. The development makes available indigenously technology hitherto held only by a few major countries.

No prize was given in the field of Biological Sciences & Technology for the year 1990. □

## **Indo-German Seminar on Electrochemistry**

Under the joint Scientific Exchange and Technical Cooperation between Indian National Science Academy [INSA] and German Research Foundation [DFG], an Indo-German Seminar on Electrochemistry was organized by the Central Electrochemical Research Institute (CECRI) at Indira Gandhi Centre for Atomic Research, Kalpakkam and CECRI, Karaikudi. The Seminar was held in two sessions. The first session on 'Surface structure and surface modification' lasting from 25 to 27 February, was conducted at Kalpakkam and the second session held during 1-3 March at CECRI,

dealt with 'Emerging concepts and technologies'.

At Kalpakkam, 30 delegates from India and Germany participated and in all 10 presentations from Germany and 11 from India on various aspects of electrochemical science and technology were made. All the presentations were followed by indepth discussions.

In the second session, 20 major presentations were made on topics in the frontier areas of electrochemistry. Considerable discussions and visits to the various laboratories cemented the closer interaction between the scientists of the two countries.

The German scientists and a few of their Indian counterparts in CECRI held a detailed discussion on the ways and means of strengthening the links established and focussing on specific goals for the future.

The next meeting was recommended to be held in 1993 before or after the ISE-Meeting in Berlin, perhaps in Duisburg. □

## **Flame-proof PAN Fibres**

Flame-proof acrylic fibre PANEX is an intermediate product between the polyacrylonitrile (PAN); precursor and the final carbon fibres. Thermally stabilized polyacrylonitrile fibres (PANEX) can provide dramatically enhanced standards of performance in a wide range of fire and thermal protection applications, meeting many specialized industrial needs as a replacement of asbestos. This is produced by heat stabilization of polyacrylonitrile (PAN) fibres. PANEX can withstand exposure to elevated temperature and direct flame contact without igniting and melting, and combines these features with high physical strength, exceptional electrical resistance

and effective chemical performance, etc.

PANEX can be produced in tows 'chopped' or 'yarn forms' from indigenously available acrylic fibres. It can be processed on the conventional knitting or weaving equipment to suit the requirement of many textile applications, which include the protective clothing for civil, military and industrial use, fire resistant upholstery fabrics and gland packings.

### **Characteristics of PANEX**

Resistance to heat degradation: PANEX based fabric or tow maintains a barrier against the flame of match stick (800-900°C) for a few minutes. It does not burn in air, does not plasticize or drip and resists shrinkage when exposed to high temperature environments. When heated in free air at temperatures above 200-300°C pure PANEX slowly oxides. When subjected to intense heat, PANEX is converted into carbon fibre. In clothing applications, resistance of PANEX to flame continues long after other textile fibre materials have charred, embrittled and cracked. Thus it gives greater protection to the wearer. PANEX provides very low thermal conductivity. Exposure to flame or extreme radiant heat produces minimal release of gases or toxic vapors and there is no 'after glow' following removal from the flame or heat source.

### **Application Segments**

PANEX in protective clothings: PANEX is today's most advanced fire-resistant textile fibre. Its ability to provide sustained flame protection at elevated temperatures gives a factor of safety that was previously unobtainable using conventional textile fabric constructions. The best available competitive materials give protection for seconds only, whereas the fire-resistance of PANEX can be counted in minutes. The extra margin of safety can give vital extended

escape time. The wear comfort of PANEX makes it suitable for the widest range of industrial protective clothing as well as protective clothing for fire service, police and armed forces personnel. It gives optimum serviceability in applications such as in motor sports, welding and the potentially hazardous environments found in iron and steel manufacturing and petrochemical processing.

### PANEX in gland packings

PANEX is recognized as being the most technically advanced and cost-effective successor to asbestos as gland packing material. Its resistance and lubricity is unmatched by competitive fibres.

PANEX in cable insulation: The unique properties of PANEX make it an ideal material for textile brading for electrical cable in a broad range of applications.

PANEX as friction linings: Chopped PANEX has wide applicability as a reinforcement for phenolic-based friction linings in both automotive and industrial usage.

PANEX in carbon-carbon applications: It can be specified as a precursor for the manufacture of C-C composites for aircraft brakes and a variety of non-aerospace components.

PANEX in activated carbon applications: Tow, yarns and cloths of PANEX are all used as precursors for high performance activated carbons, now used on an increasing scale in the medical, industrial and the military fields.

The National Physical Laboratory (NPL), New Delhi, has developed on a continuous scale, an indigenous process for the manufacture of flame proof acrylic fibres. The process which requires precisely controlled heating of acrylic fibres, makes use of the indigenously available raw materials.

### Characteristics of 'PANEX' developed at NPL

Denier	: 1.5
Density	: 1.5 g/cc
Tenacity	: 16 g/d
Elongation at break	: 15%
Electrical resistance of the order of	: $10^{10}$ ohm/cm
Number of filaments	: $10^4$ - $3.6 \times 10^5$ /tow
Diameter	: 11-15 $\mu$ m
Carbon contents	: 60%

It is non twisted and can withstand flame temperature of matchstick ( $\sim 800^\circ\text{C}$ ) for few minutes.

The NPL process know-how for PANEX has been already transferred to M/s Jagjiwan Enchem Udyog Ltd, Shreeji House, Ellisbridge, Ahmedabad. □

### ONGC design consultancy assignment to CSIR Engineering Services Division

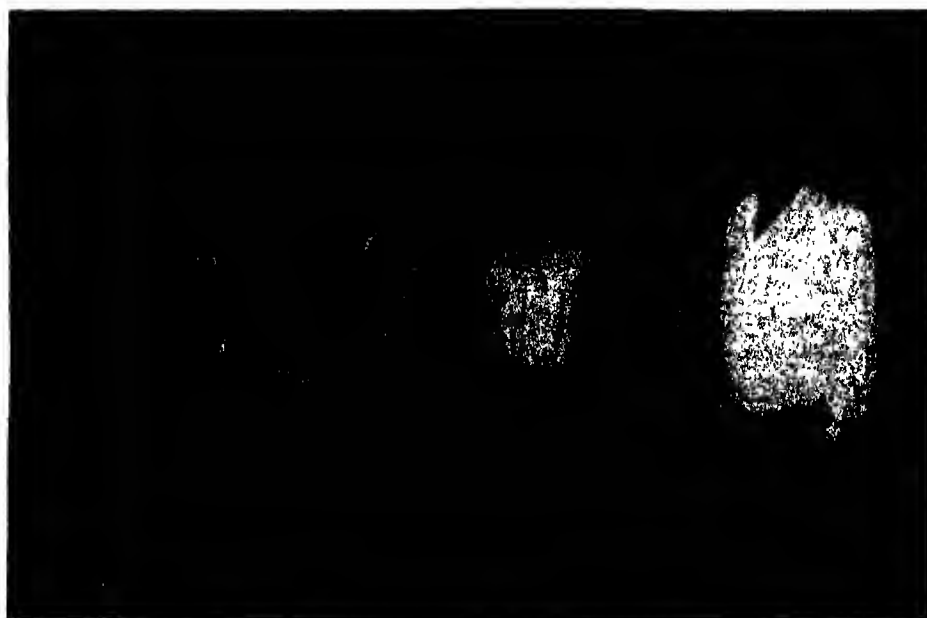
The Oil & Natural Gas Commission has commissioned the Engineering Services Division of CSIR for

providing design consultancy in respect of ONGC's proposed Institute of Biotechnology and Geotectonic Studies (INBIGS) near Jorhat (Assam). The Memorandum of Understanding for this design consultancy was signed recently at Nazira (Assam) by Shri Mool Chand, Regional Director, ONGC and Dr M.P. Dhir, Director (Engineering Coordination), CSIR.

The building for INBIGS is expected to cost Rs 100 million. To advise on the functional planning of this specialized laboratory, an Expert Group has been set up in CSIR. □

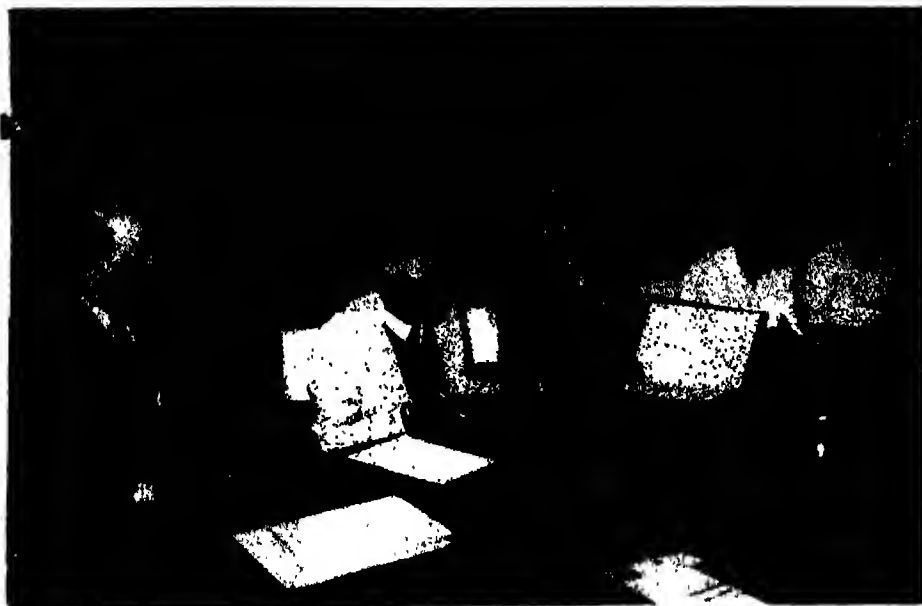
### BHEL (Bhopal), RRL (Bhopal) and PWL take up project on development of fibre-glass reinforced plastic material for gear cases

The Bharat Heavy Electricals Ltd's Bhopal Unit, in association with the Regional Research Laboratory, Bhopal and the Permal Wallace Ltd, has worked out a project to develop fibre-glass reinforced plas-



Dr M.P. Dhir, Director, Engineering Coordination CSIR (left) and Shri Mool Chand, Regional Director, ONGC, exchanging MoU





## CSMCRI-HSL agreement for installation of in- digenous potash plant at Kharaghoda

An agreement was signed between the Director, Central Salt & Marine Chemicals Research Institute, (CSMCRI) Bhavnagar, and the Chairman- cum-Managing Director, Hindustan Salts Limited (HSL), Jaipur, for installation of a demonstration plant for the production of chemical grade potassium chloride at Kharaghoda (Gujarat) at a cost of Rs 19.8 million. The Department of Ocean Development, Government of India, will be financing this venture.

At present our entire need of potassium chloride is met by import. The objective of this venture is to prove the techno-economic viability of the technology developed by CSMCRI, for the production of this extremely important chemical. In this process, the waste effluent of bittern produced after the production of salt from the salt works of Kharaghoda would be utilized.

A MoU being signed by Prof. T.C. Rao, Shri S.K. Handa and Shri C.C. Sakarda, for development of fibreglass reinforced plastic material for gear cases

tic material for the gear cases of traction motors. The new composite material will make the gear cases exceptionally light, chemically resistant and more durable.

A memorandum of understanding has been signed in this regard recently by Shri S.K. Handa, General Manager (Incharge), BHEL; Prof. T.C. Rao, Director, RRL and Shri C.C. Sakarda, General Manager, Peramali Wallace Ltd. Shri Intezar Hussain, GM(Personnel), BHEL and Shri Ashok Gupta, DGM(New Products), were also present on the occasion.

technology is less arduous, economical and simple for mass scale production of these artefacts. Held in association with the M.P. Antyavasayee Vikas Nigam Ltd and the District Administration of Raigarh, the demonstration programme was conducted by Shri B.K. Saxena and Dr A.K. Gupta of RRL- Bhopal.

□

## Demonstration of RRL- Bhopal's Bell Metal tech- nology to Village Artisans

The Regional Research Laboratory (RRL), Bhopal, conducted an on site programme for tribals and artisans of the Ektal village in Raigarh (M.P.), during 12-27 December 1990, demonstrating its technology for the production of bell metal artefacts. The RRL's



Demonstration of bell metal technology to village artisans of Ektal village in Raigarh



The Director, CSMCRI (left) and the Chairman-cum-Managing Director, HSL, after signing the agreement for the installation of indigenous potash plant at Kharaghoda

The process involves production of crude carnalite  $\text{KCl} \cdot \text{MgCl}_2 \cdot 6\text{H}_2\text{O}$  (mixed salt) by solar evaporation of bittern (an effluent of salt industry). Mixed salt is collected from solar pans and decomposed with water to produce a solid mixture of potassium chloride and sodium chloride. A specially prepared solution extracts potassium chloride from this solid mixture at high temperature. The hot extract on cooling deposits potassium chloride which is separated by filtration and the liquid is recycled. □

### Synthetic Studies on Agrochemicals and Chemical Transformation of Terpenes

Shri S.M. Toke of the National Chemical Laboratory (NCL), Pune, achieved the synthesis of  $\gamma$ -lactone of 1R- (cis)-2, 2- dimethyl- 3- (2,2,2-tribromo-1-hydroxyethyl) cyclopropane carboxylic acid from (+)-3-carene by a novel sequence of transformations. 2,2-Dimethyl-3- (2-methylprop-1-enyl) cis-1- (hydroxymethyl) cyclopropane, obtainable from (+)-3-carene by a

reported procedure, was converted to the corresponding aldehyde by pyridinium chlorochromate (PCC). The latter was reacted with tribromomethyl carbanion to give the tribromoalcohol, which on ozonolysis followed by oxidative work-up with Jones chromic acid reagent, afforded in the neutral part, the tribromolactone, and in the acid part the tribromohydroxy acid. These are important intermediates in the synthesis of 1R- (cis)- 2,2-dimethyl-3- (2,2-dibromovinyl) cyclopropane carboxylic acid from which the highly potent pyrethroid deltamethrin is synthesized.

2,2-Dihalocyclopropane carboxylic acids with alkyl substituents at 1 and 3 positions were synthesized by two different approaches and their conversion to the insecticidally active 3-phenoxybenzyl and (RS)cyano-3-phenoxybenzyl esters was carried out.

Dichlorocyclopropanation of isoprene monomer with dichlorocarbene, generated *in situ* from chloroform and 50% aqueous sodium hydroxide under phase

transfer conditions using TEBA as catalyst, gave 1-methyl-1-vinyl-2,2-dichlorocyclopropane which was subsequently oxidized with potassium permanganate under neutral condition to give 1-methyl-2,2-dichlorocyclopropane-1-carboxylic acid, characterized through its methyl ester. This was also prepared from methyl-2-methyl acrylate by direct dichlorocyclopropanation using the method mentioned above. By employing similar sequence of the reactions the corresponding dibromo acid was also synthesized. Both the dihalo acids were converted to their corresponding 3-phenoxybenzyl and  $\alpha$ -(RS)-cyano-3-phenoxybenzyl esters, exhibiting good insecticidal activity against yellow fever mosquito, *A. aegypti*, culex larva, and *Musca domestica*. Similarly, the other structurally related esters were synthesized starting from piperylene (1,3-pentadiene).

Analogues of 2,2,3,3 tetramethyl cyclopropane carboxylic acid were prepared from naturally occurring monoterpene (+)pulegone by Michael addition reaction using ethyl(dimethylsulphuranylidene) acetate (EDSA). The keto ester thus obtained was converted into corresponding 3-phenoxybenzyl and (RS)cyano 3-phenoxybenzyl esters. By employing the reaction with EDSA on conjugated carbonyl compounds, cyclopropane keto esters were also prepared starting from (+)-carvone and isobutyridine methyl heptanone, for evaluation of their insecticidal activity.

2,3-Secopyrethroids possessing a phenyl substituent to the carboxylate function was obtained from methyl/phenyl acetate by monoalkylating it with different allyl halides and subsequently converting the resulting monoalkylated esters to the corresponding 3-phenoxybenzyl esters.

The synthesis of 3-phenoxybenzyl 2,2-dihalo-cyclopropyl ethers derived from naturally occurring monoterpenes has been described. The ethers were prepared with a view to evaluating these for insecticidal activity.

Shri Toke carried out the above studies under the guidance of Dr G.H. Kulkarni, and was awarded Ph.D. degree by the University of Pune for his thesis based on these studies. □

## PROGRESS REPORTS

### CIMAP Annual Report: 1989-90

The salient achievements accomplished by the Central Institute of Medicinal and Aromatic Plants (CIMAP), Lucknow, during 1989-90, according to its annual report for the period, are as follows:

A few superior somaclonal lines of Japanese mint developed by the Plant Tissue Culture Division exhibited better performance over the parent variety: CIMAP/Hyb-77, tested at Lucknow and Pantnagar.

In a significant development in protoplast fusion studies, somatic hybrids were developed at inter-generic level between *Atropa bel-ladonna* + *Hyoscyamus muticus* and *Hyoscyamus muticus* + *Nicotiana tabacum*.

Secondary metabolites of *Panax*, viz. ginsenosides, were extracted from callus cultures of American ginseng.

Under genetic improvement programme of rose, a superior clone RSL-31 was evolved as one of the best genotypes, containing more geraniol and rhodinol + geranyl acetate in the oil as compared to Bulgarian rose oil.

Genetically superior and stable artificial autotetraploids with over 90% seed set were developed in *Hyoscyamus niger*, yielding 22.5%

more tropane alkaloids as compared to parent diploids.

The Plant Pathology Division for the first time cultured vesicular- arbuscular mycorrhiza (VAM) fungus on synthetic medium. This discovery is a major breakthrough in mycorrhizal research and has widespread application in agriculture.

Studies carried out in the Agronomy and Soil Science Division indicated that lentil could be intercropped with palmarosa successfully giving an yield of 6 q/ha.

Application of 60 kg sulphur/ha in opium poppy was found to enhance the seed and oil yield significantly.

Diuron (1.5 kg/ha), simazine and diuron (each 3.0 kg/ha) with organic mulch were found to control weeds significantly in *Rosa damascena*.

Physiological basis of drought tolerance in lemongrass was studied and it was found that oil content increases significantly due to moisture stress condition.

The plant growth regulator, GA<sub>3</sub>, increased the plant height and artemisinin content as well as oil content in *Artemisia annua*. A novel compound 6-(3'-methyl-butylamino)-2-hydroxy-7, 8-dihydropurine was also isolated from the plant.

Adjoining areas of Shahdol and Mandla districts of Madhya Pradesh were surveyed for plants of medicinal and perfumery value and about 30 herbarium specimens of important medicinal and aromatic plants were collected, identified and processed.

In the studies carried out in Medicinal Plant Chemistry Division, the saponin fraction of *Asparagus adscendens* has yielded two new steroidal glycosides. An alkaloid, echinozolinone from *Echinops echinatus* possessing anti-inflammatory property was synthesized. *Trans*-phytol was isolated

from the plant *Phyllanthus niruri*. A new host-nonspecific phytotoxin, drechslerol-C was isolated from the culture filtrate of *Drechslera maydis* causing severe leaf blight disease in *Costus speciosus*.

The arteether was prepared in adequate quantity from artemisinin and was provided to Central Drug Research Institute, Lucknow, for further clinical trials. A new and water-soluble analogue of artemisinin, sodium p-(12 $\alpha$ -dihydroartemisininoxy) methyl benzoate showing antimalarial property was synthesized and an Indian patent was filed for this.

Biosynthesis of artemisinic acid in *Artemisia annua* using radioactive mevalonate was worked out. Similarly, the biosynthesis of sesquiterpenes of vetiver was also studied.

Under the programme an screening of natural products as pesticides, the extracts of 13 plants were tested, the extract of *Achania* sp. exhibited good feeding deterrence.

An efficient and low-cost distillation unit for production of quality rose oil was designed, fabricated and installed by the Chemical Engineering Division at Bonera Farm of CIMAP in Kashmir and preliminary trials were conducted in June, 1989. This unit is directly-fired type and any agrowaste may be used as fuel. A patent has since been filed to secure the invention.

The conditions for high vacuum fractionation of citronella oil were standardized to produce valuable aroma chemicals such as citronellal, d-citronellol, geraniol, mixture of geranyl acetate, geranyl formate and citronellyl acetate and limonene.

Ninety-four research papers were published by the scientists of CIMAP in various reputed national and international journals.

Under the technology transfer programme, activities were geared up to make them more user

responsive in the light of new CSIR guidelines so that sufficient cash-flow could be generated through such services. The institute provided technical knowhow/consultancy to nine parties and earned an amount of about Rs 0.1532 million as fee. This includes survey in Maharashtra State for cultivation of peppermint and spearmint on behalf of M/s. D.D. Shah & Co., Bombay, know-how for production of menthol to three parties, supply of seeds of improved variety of palmarosa (*Trishna*) to Government of Bhutan and technology for ergot cultivation to M/s. Bio-med, Baroda.

Being the lowcost and simple to fabricate and operate the CIMAP field distillation unit has attained popularity among essential oil producers in the country. Eight parties obtained design of this unit on payment during the year. In addition, the institute provided free technical advice and assistance to more than 1500 farmers for cultivation of medicinal and aromatic plants, distillation of aromatic plants, quality evaluation and marketing of their produce.

As a result of transfer of technologies to the private and public sectors, the country produced essential oils and ergot worth over 460 million of rupees and saved an equal amount as foreign exchange.

Training was provided to nine fellows from Vietnam, Myanmar (Burma) and Sri Lanka in the field of medicinal and aromatic plants. The trainees were sponsored by UNIDO/WHO.

The institute participated in various exhibitions such as Nehru & Science Exhibition, Khairatabad, Andhra Pradesh; All India S&T Demonstration Campaign, Ottapalam, Kerala; India International Trade Fair, New Delhi and Nehru Kisan Mela, Allahabad. These exhibitions made people aware of the role of medicinal and aromatic plants in poverty alleva-

tion and improvement of quality of their life. □

### CFB Annual Report: 1989-90

The major thrust area programmes of the CSIR Centre for Biochemicals (CFB), Delhi, are in the field of drugs, diagnostics and reagents. Presented below is a brief account of the R&D work carried out by the Centre, under the different areas, during 1989-90.

Pollen calendars were prepared for 12 states, which would be useful as diagnostic aids for allergy specialists; 150 cultures of thermophilic actinomycetes were collected which are known to be involved in farmer's lung disease. Work was continued on immunodiagnostic kits and mapping on the genome of nuclear polyhedrosis virus. Preliminary work was taken up to study the feasibility of bioconversion of municipal market wastes into methane.

A large number of orders for chemicals and reagents required for DNA synthesis and custom made oligonucleotides were received and these were fulfilled as per the requirement. Polymer supports were prepared for DNA synthesis. Tetrazole and phosphoramidites were synthesized. Methodology for CED amidites was standardized and batches of T&C CED-amidites were prepared; work was being carried out to prepare A&G CED-amidites. A number of custom-made oligonucleotides were prepared and supplied to the scientists working in different fields in the country.

The technique for isolation of glycolipids especially gangliosides was standardized, using a newly developed reverse phase chromatography matrix which has been patented under the name of LIPSEP gel. The procedure, published in the *Journal of Chromatog-*

*raphy*, gives a quick purification of gangliosides.

Routine production of other phospholipids was continued.

Blood group A specific lectin was purified to homogeneity. Some of the physical properties were worked out. Biological functions of this purified lectin in the host were being investigated.

Several batches of various biochemicals, proteins, enzymes, carbohydrates, etc. were prepared, and offered for sale. These biochemicals include bovine serum albumin (BSA), ammonium sulphate (enzyme grade), F.C. reagent, lysozyme, hyaluronidase, glycylglycine HCl, nutritional cellulose, *p*-nitrophenol, cholesterol (crystalline), phytohemagglutinin M, rice starch, haemoglobin (urea denatured) catalase, carboxymethyl cellulose, peroxidase etc. The sale value of these chemicals amounts to Rs 2.5 lakh.

An international symposium on 'Separation technique in biology' was held during 29 November-7 December 1989 with the help and cooperation of various scientists and Dr M.A. Vijayalakshmi of the University of Compiègne. Several world renowned figures including Prof. J. Porath of Uppsala University, Sweden and Prof. P.G. Righetti of University of Milano, Italy, participated in the symposium. Alongwith this, a workshop to train young scientists in several techniques of separation was also organized.

Another major event was the hosting of the second International Symposium on Biochemical Roles of Eukaryotic Cell Surface Macromolecules. Prof. B.K. Bachhawat from the University of Delhi, South Campus, helped in organizing the symposium. The symposium was attended by 45 scientists from India and 66 scientists from abroad. Also two workshops were held to train physicians in allergy and immunotherapy. J

## **IED - PTC Demonstration - cum - Training Programme on Food and Agro - based Technologies at Madhopur**

The Institute of Entrepreneurship Development (IED) and the Polytechnology Transfer Centre (PTC), Patna, jointly organized a Demonstration-cum-Training Programme on Food & Agro-based Technologies at Madhopur Agricultural Regional Centre, West Champaran (Bihar), from 22 to 27 April, 1991, wherein 28 local entrepreneurs participated. Three scientists from the Central Food Technological Research Institutes, Regional Centre at Lucknow demonstrated technologies for preparation of bakery products, papads, adauri, leaf plates and cups, pickles and preservatives and processing of turmeric and spices.

Speaking on the various agro-based technologies, Shri Naseer Ahmad, Project Officer, stressed the need for such industries, especially in the West Champaran district which has enormous scope for such units. He also assured to provide guidance to all those entrepreneur trainees who were willing to enter into the venture.

The Chairman and General Manager of Champaran Chhetriya Gramin Bank appreciated the programme and assured to provide financial help to the entrepreneurs trained under the programme.

Appreciating the programme, the Chief Scientist of Rajendra Agricultural University, stated that this was an unique opportunity for the young entrepreneurs in the district and hoped that PTC's efforts would bring a fruitful result in the industrial development of the predominantly agricultural belt of West Champaran. □

## **TRAINING COURSES**

### **Integrated Training Programme on Innovative Materials and Techniques for Housing**

An integrated training programme on Innovative Materials & Techniques for Housing was organized in collaboration with COSTFORD, Thrissur; DST, HUDCO; National Environmental Engineering Research Institute, Nagpur; Central Road Research Institute, New Delhi; and Structural Engineering Research Centre, Ghaziabad, from 11 to 15 March 1991, at Ayyanthole, Thrissur (Kerala) to impart training to trainers. The use of locally available materials for housing, purification and safe storage of water, storage of food grains, rural roads and rural sanitation were the main topics covered in the training programme by way of technical deliberations/discussions, audio/visual presentations, and live demonstrations on site. The techniques pertaining to improve rural houses and environment, labour intensive technologies (precast walling and roofing com-

ponents) were demonstrated through prototype constructions.

Two hundred forty participants comprising engineers, architects, builders, entrepreneurs, senior officers, social workers, etc. from about 50 organizations covering the states/UTs of Kerala, Tamil Nadu, Andhra Pradesh, Madhya Pradesh, Maharashtra, Karnataka, Pondicherry, Orissa, West Bengal, Manipur and New Delhi attended the programme.

An exhibition was also arranged in which a large number of charts pertaining to the theme of the training programme were displayed. □

### **Children Meet Scientist's Programmes at CIMAP, CRRI and CECRI**

'Children Meet Scientists' programmes under the sponsorship of the National Council of Education Research and Training (NCERT), New Delhi, were organized at the Central Institute of



Participants of the Training Programme on Innovative Materials and Techniques for Housing being explained the construction of RC components for housing



Medicinal and Aromatic Plants (CIMAP), Lucknow; Central Road Research Institute (CRRI), New Delhi and the Central Electrochemical Research Institute (CECRI), Karaikudi, on 6 March, 19 February and 4 March respectively. The objectives of the programmes were to bring the students in direct contact with scientists to gain first hand knowledge of the current researches being carried out in the institutes, to inculcate an innate ambition in the students to pursue higher studies in sciences and to provide an occasion to students to exchange their ideas on different science concepts.

At CIMAP, the children were apprised of the research and development activities of the institute through a video film and a visit to museum, experimental farm and pilot plants and laboratories. Dr. R.S. Thakur, Director described as to how plant herbarium is established.

The function of CRRI was presided over by Prof. D.V. Singh, Director. Dr S.M. Sarin spoke on road safety and discussed the various reasons responsible for the high rate of road accidents. He put forth a number of corrective measures for implementation to bring down the rate of road accidents. Dr P.S.K.M. Rao in his talk explained the mechanism involved in the use of radio isotopes for pavement evaluation.

Dr N.P. Singh, Consultant in Anaesthesiology & Resuscitation spoke on 'Save a Life - Cardio Pulmonary Brain Resuscitation and supplemented his lecture with demonstration by teaching and training aids.

At CECRI, Karaikudi, Prof. Fritz Beck of Duisburg University, Germany inaugurated the programme and Prof. S.K. Rangarajan, Director, presided. The following lectures were delivered: 'Electromagnetic spectrum' by Dr R. Srinivasan. 'Three faces of

Electrochemistry' by Dr M. Noel both from CECRI; Power generation by Shri K. Bhaskaran, Electrical Engineering Department, A.C College of Engineering & Technology, Karaikudi and 'Visions' by Dr R. Sabesan, Head, Physics Department, Alagappa University, Karaikudi. The students were also exposed to the advanced sophisticated analytical instruments available at CECRI. □

### PATENTS FILED

1169/DEL/90: A process for the inactivation of oil palm fruit lipolytic enzyme by microwave treatment, P.P. Thomas, N. Gopalakrishnan, A.D. Damodaran — Regional Research Laboratory, Trivandrum.

1170/DEL/90: A novel dry process for palm oil extraction, N. Gopalakrishnan, P.P. Thomas and A.D. Damodaran — Regional Research Laboratory, Trivandrum.

1204/DEL/90: A process for the production of Fe-Mn-Al alloys for soft magnetic applications, V. Rao, S. Pramanik, C. Tewari and O.N. Mohanty — National Metallurgical Laboratory, Jamshedpur. □

### Public Relations, Exhibition & Information Unit of CSIR renamed as Unit for Science Dissemination

The Public Relations, Exhibition & Information Unit at the CSIR Headquarters, Rafi Marg, New Delhi, has been renamed as the Unit for Science Dissemination. The Unit is presently headed by Shri T.D. Nagpal. □

### ANNOUNCEMENTS

#### Refresher Courses at CRRI during 1991

The Central Road Research Institute (CRRI), New Delhi, will be organizing the following courses during July-December, 1991:-

(1) Training Course on Use & Maintenance of Automatic Road Unevenness Recorder/ Profilograph/ Bump Integrator & Introduction to Other Related Devices (3-9 July),

(2) Training Programme in Elastomeric Bearings for Bridge Design Engineers (5-9 Aug),

(3) Refresher Course in Traffic & Transportation Engineering (20 Aug. - 1 Oct.),

(4) Sr. Refresher Course for Highway Engineers (9 Oct.- 1 Nov.),

(5) Training Programme in Procedures of Material Testing & Quality Control Techniques of Highway Construction (13 Nov.-5 Dec.) and (6), Training Course on Use and Maintenance of Automatic Road Unevenness Recorder/ Profilograph/ Bump Integrator and Introduction to other Related Devices (18-24 Dec.).

For detailed information, contact the Head, Information, Liaison and Training Division, CRRI, New Delhi 110 020. □

### Training Course on Plant Tissue/ Cell Cultures for the Production of Phytochemicals and for Plant Improvement

The Department of Biotechnology - sponsored short-term training course on Plant tissue/cell cultures for the production of phytochemicals and for plant improvement will be held at the Central Food Technological Research Institute, Mysore, during 8-26 July, 1991.

The training course is for personnel from universities, R&D institutions and industries interested in learning advanced knowledge and techniques of plant tissue and cell cultures with an emphasis on the production of phytochemicals.

Further details can be had from: The Course Director, Dr L.V. Venkataraman, Area Coordinator, CFTRI, Mysore 570 013. J



# CSIR NEWS



A SEMI-MONTHLY  
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Articles prepared using glassy carbon developed by NPL, New Delhi, by controlled carbonization of a suitable self-synthesized phenol formaldehyde resin precursor (p.128)

## IN THIS ISSUE

Brain Storming Session on Electrometallurgy	126	INSDOC Annual Report: 1989-90	130
DOD sponsors Project at CEGRI on Marine Pollution Monitoring and Modelling	127	Training Course on Electroplating and Anodizing	131
Commercial Molybdenum Recovery Plant	129	CSIR-IGBP Fellowships	132
Enzyme-based Biosensors for Glucose	130		

## Brain Storming Session on Electrometallurgy

Considering the silent revolution that is taking place in materials technology and a committed drive for energy saving in electrometallurgical processes one finds continual shift in priorities, options and strategies. This is reflected in the development of newer cells and emphasis on recovery of metals from secondary and non-conventional sources. To take stock of such changes in scenario, to review the present status, and to have a free exchange of ideas, a brain storming session on 'Electrometallurgy and Electrothermics' was organized at the Central Electrochemical Research Institute, (CECRI), Karaikudi, on 27-28 January 1991.

The inaugural session was presided over by Prof. S.K. Rangarajan, Director, CECRI and inaugurated by Dr Ram K. Iyengar, Additional Director General, CSIR.

Prof. Rangarajan in his presidential address emphasized the need for material development, and process development towards energy saving in metallurgical processes. He pointed out that production of energy as well as its effective utilization has to be planned at all levels. He underscored the need to draft a comprehensive technology plan with the interaction of the scientists.

Dr Iyengar in his inaugural address said that fraternal interaction between various research institutions was very much needed for transformation of attitude. Turning to energy crisis, Dr Iyengar said that the government and appropriate research institutions should come forward to develop electric vehicles. He stressed that in the area of metallurgy, research should be based on our resources, needs and strength. Stating that aluminium would gain a pivotal role in the coming years, especially

with the present energy crisis, he said that the technology for aluminium production should emerge from institutes like CECRI. It should not be imported from countries like France, which are not having any aluminium ore deposit. He also stated that Hindustan Copper Ltd has given Rs 9.3 million for extraction of nickel, wherein CECRI and other sister laboratories will be collaborating.

Dr R. Krishnan, Director, Turbine Research Institute, Bangalore and Chairman of the Research Advisory Committee of CECRI said that alloys of required standard were not available indigenously. These were scarce even in developed countries. He suggested that our country should develop such alloys.

The inaugural function was followed by a technical session in which the following experts participated and helped in formulating R&D proposals in the metallurgical area: Dr Ram K. Iyengar (CSIR); Dr R. Krishnan (Chairman - RC); Dr U.K. Chatterjee (Member - RC);

Shri R.B. Subramanyam (DMRL); Shri P. Parvathisem (HZL); Shri N. Manoharan (MALCO); Prof. S.Venkatachalam (IIT); Shri N. Saratchandran (NFC) and Dr P.N. Mohandas (RRL).

The following recommendations were made for future R&D:

### A. Electropyrometallurgy

1. Development of technology for aluminium production: (i) Development of inert anodes and their testing; (ii) Titanium boride as a material for cathode lining of Al pots. Funding to be done by the aluminium industries.

2. Development of bipolar cell for magnesium production at CECRI, and setting up of a pilot plant at DMRL, Hyderabad.

3. Reclamation of zirconium and titanium from metallic scraps by fused salt electrolysis.

4. Setting up of a commercial unit for calcium metal and purification of calcium metal (This work to be carried out in consultation with BARC).



Dr Ram K. Iyengar, Additional Director General, CSIR, delivering the inaugural address

5. Consolidation of R&D activities on rare-earths production [DMRL, BARC, CECRI & RRL(Trivandrum) to be associated and funding to be done by DRDO, DAE].

#### **B. Electrohydrometallurgy**

1. Gallium extraction: (i) Cementation to be carried out on lab scale level to come out with a process design for a 50 kg unit; (ii) CSIR and aluminium industries to establish a 50 kg unit; and (iii) Purification and characterization of gallium to seven nines purity.

2. Development of suitable catalytic anodes for electrohydrometallurgical operations in general and of catalytic anodes for nickel sulphate and

nickel chloride electrolysis in particular.

3. Recovery of lead in powder form from lead sulphate sludge, suitable for batteries with simultaneous recovery of silver.

4. Development of technology for cobalt powder from cobalt sulphate/metal, suitable for its use in tungsten carbide preparation.

5. Recovery of nickel, tungsten values from scrap.

6. Studies on continuous on-line analysis for monitoring zinc electrolyte.

7. Electrolytic grade manganese dioxide from anode mud (zinc industry). ▽

detect radical changes in the biogeochemical regimes of the oceanic system and to alert government, public and social institutions of their implications; and develop mathematical models both for predicting the dynamics of pollution and ecological regimes along our coasts.

Marine pollution work is required to understand the chronic effects of pollution and to forecast future risks. In view of the inherent variability of ecological systems at different places, physiological criteria will be taken as essential component of ecological baseline study. Irrespective of how sophisticated chemical monitoring techniques become, they will not provide information on the status of the biological components of the ecosystem. Hence a combination of chemical and biological monitoring of the marine environment will be taken into consideration for this pollution monitoring programme.

### **DOD sponsors Project at CECRI on Marine Pollution Monitoring and Modelling**

In order to protect the integrity of our marine environment and the precious resources which it supports, it is imperative to understand the structure of the marine ecological system and its response to changes in the biochemical regimes. The Department of Ocean Development (DOD), New Delhi, has identified a national programme on 'Marine Pollution Monitoring' along Indian sea coast from the shoreline upto a distance of 20 kms into the sea. The work has been assigned to various organizations in the country from a geographical viewpoint both along eastern and western sea coasts. The Central Electrochemical Research Institute (CECRI), Karaikudi, has been chosen as the nodal agency to conduct pollution monitoring work along eastern coast from Pulicat lake (Andhra Border) upto Cape Comarin. CECRI unit at Madras is to take up this work which covers the region from Andhra border upto Man-

dapam. The duration of this project is three years.

The objectives of the project are to: establish a knowledge base in the field of biogeochemical parameters in estuaries and in the continental shelf and open seas; operate an appropriately structured information system for ready dissemination of various data to users in government, industry, research and social institutions and to provide advisory and technical services to these agencies for evolving pollution containment parameters; conceptualize and implement R & D programmes that will continually update the knowledge and information bases and develop analytical frameworks for the quantification of transport rates and inputs of various chemical elements to different reservoirs and to the sea towards characterizing the ecosystem; assessing its digestive capacity and in turn delineating policy options and facilitating decision processes;

Pollution potential coastal areas (transects) will be chosen on the basis of location of industries, urban establishments and ecological sensitivity.

The nature of work involves the collection of sea water samples, sediments and organisms from different transects at different distances and analyze the same both by chemical and biological means. From these data, the extent of pollution in marine atmosphere will be correlated to the nature of the transects chosen.

Finally, mathematical models of marine systems will be considered, because this is an emerging area of research and gives a better understanding of the chemical, biological and other process dynamics in the marine ecosystem. These models also assist in the administration of water resources and fight against pollution ▢

## Development of Glassy Carbon at NPL

Glassy carbon is a newer form of carbon which combines some of the characteristics of glass such as lusture, hardness, mode of fracture, imperviousness, etc. with the other characteristics of industrial carbon. It possesses low density, high strength and hardness, high resistance to corrosion and erosion, and low porosity and permeability. Because of this, it finds numerous applications in the analytical, bio-medical, electrical, mechanical, metallurgical and electronic fields. This type of carbon is being manufactured by only a few firms in the world with none in India.

Glassy carbon has been developed in India at the National Physical Laboratory (NPL), New Delhi, by the controlled carbonization upto 1000°C or higher, of a suitable self-synthesized phenol formaldehyde resin precursor. The team of innovators of this process comprises Dr Gopal Bhatia, Dr R.K. Aggarwal and Dr O.P. Bahl of NPL.

The characteristics of the NPL-made glassy carbon compare well with those of the best imported ones available commercially. Some of the important characteristics of the NPL glassy carbon : (HTT 1000° C) are :

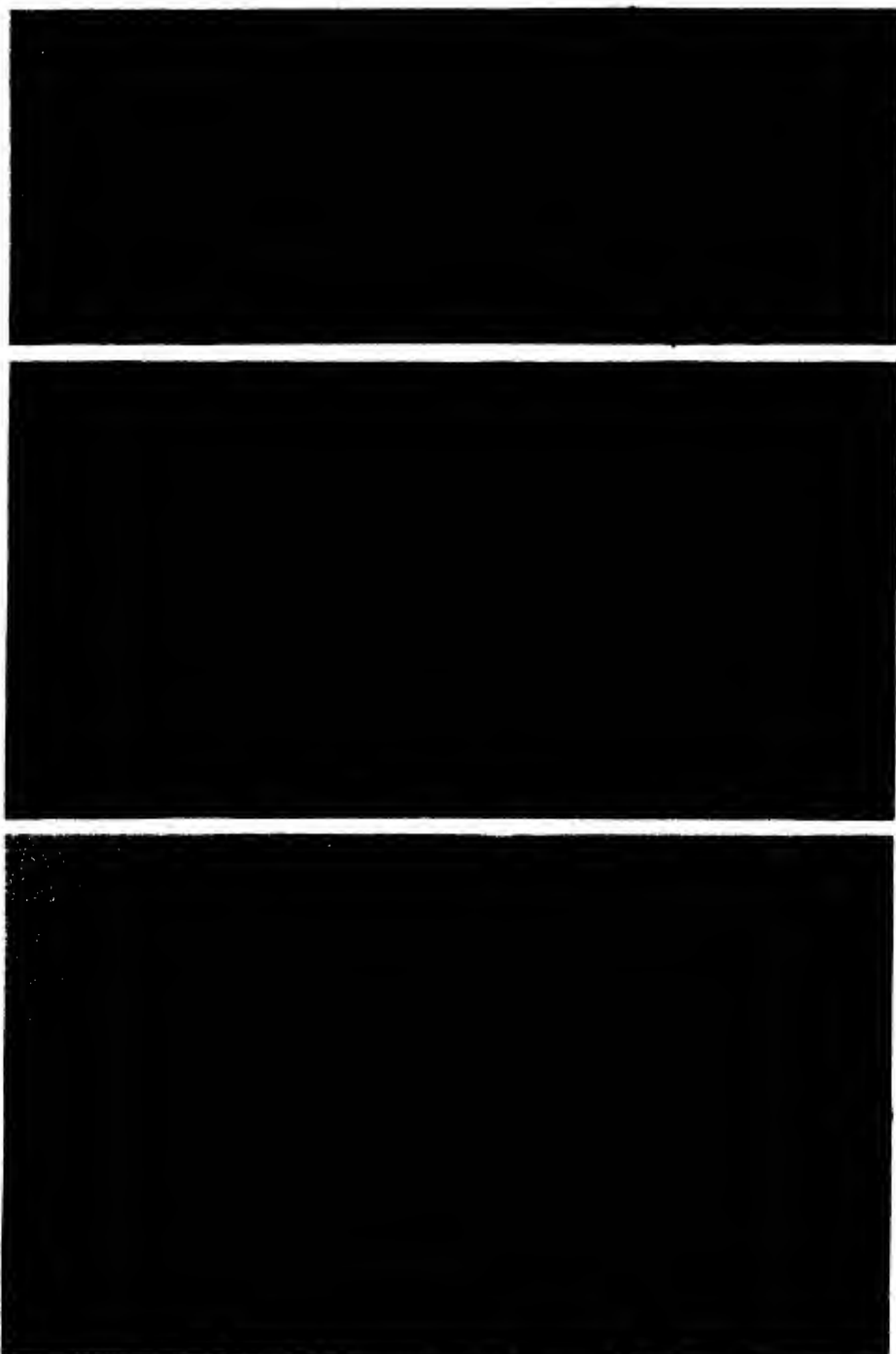
Bulk density, gcm <sup>-3</sup>	1.50 - 1.52
Open porosity, %	1.04 - 1.13
Transverse breaking strength, MPa	138 - 142
Young's modulus, GPA	29.0
Shore hardness	95 - 97
Electrical resistivity, m ohm cm	7.9 - 8.1

The glassy carbon articles of different shapes and sizes such as

plates, rods, crucibles, tubes, boats etc. have been prepared at NPL for various applications. Glassy carbon crucibles and resistor plates have been found to work successfully for silicon processing and thin film deposition work respectively. Glassy carbon dental implants have been designed and developed at NPL and subjected to clinical tests and subsequently to

field trials on animals and human beings for replacing damaged teeth, in collaboration with Army Hospital, Delhi. The implantations onto 40 human beings carried out at this Hospital have been found to be highly successful.

Infact, NPL has already transferred the technology of the process for the production of glassy carbon in various shapes and designs, to a



Glassy carbon used for dental implantation

TABLE I

<i>Field of industry</i>	<i>Product obtained</i>	<i>Method of use</i>
1. Chemical and analytical	Various aggressive chemicals	(a) As chemical reactors, crucibles, tubes, boats, (b) As replacement for expensive receptacles e.g. silica, platinum, iridium etc.
2. Electronics	Group III-V semiconductors	As tubular crucibles and boats in the processing of group III-V semiconductors.
3. Metallurgical	Metals and alloys	(a) As crucibles for zone refining of metals such as Al, Zn, Ag, Pb etc. (b) Vacuum evaporation of metals (Al, Ni and Cr).
4. Mechanical	(a) Glass technology, (b) Engines pumps and turbines	(a) As jigs and fixtures for glass moulding, (b) As bearings and bushings for pumps and turbines for turbomotor.
5. Bio-medical	(a) Dental implant material, (b) Heart valve disc	(a) As replacement of tooth in both human and animal applications, (b) To replace damaged heart valves in human body.
6. Electrical	Fuel Cell	As separator plates in Fuel Cells.

major carbon industry in India, namely Graphite India Ltd, Bangalore.

The various applications of glassy carbon are given in Table I.

### Commercial Molybdenum Recovery Plant

The proposed molybdenum recovery plant of the Hindustan Chemicals Ltd (HCL) at Rakha involves 9 stages of cleaning with 2 intermediate grinding stages to raise the grade to 53% Mo with 75-80% recovery from a feed containing 0.25% Mo.

However, the Regional Research Laboratory (RRL), Bhubaneswar, has rendered consultancy services to HCL and demonstrated that by using two columns and one intermediate



Commercial molybdenum recovery plant with RRL - Bhubaneswar's technology

grinding the grade could be raised to 53% with an overall recovery of 83%.

HCL has placed orders as per the suggestions of RRL(Bhu) for most of the equipment necessary to handle 40 tonnes/day copper concentrate to produce 0.15 tonnes/day of 53% Mo concentrate. The commercial production of Mo is expected during the middle of 1992. □

## Enzyme-based Biosensors for Glucose

Biosensors using electroanalytical principles for a variety of applications ranging from the determination of blood glucose to monitoring of BOD in aquatic samples are emerging as useful devices presently world over. Several groups of researchers, both within our country and abroad are making serious efforts to bring out rugged and practical versions of these sensors for routine applications.

The Central Electrochemical Research Institute (CECRI), Karaikudi, which undertook this work under the institute's thrust area programmes a few months ago, has succeeded in developing an amperometric sensor for glucose using a glucose oxidase enzyme immobilized electrode surface acting as an electrocatalyst for oxidation of glucose. The sensor which gives reproducible electrical signal for a glucose concentration of 0-15 mM over several weeks with no appreciable degradation of the enzyme activity (lasted for more than 4 weeks and responded to more than one thousand assays so far), more than matches in its performance with similar one being discussed in contemporary works. It is being integrated with an electrical measurement system to form a glucose monitoring kit for commercial exploitation. □

## PROGRESS REPORTS

### INSDOC Annual Report: 1989-90

The annual report of the Indian National Scientific Documentation Centre (INSDOC), New Delhi, for 1989-90 shows that the scientific programmes and information services of the institute were reorganized during the year with the objective of transforming INSDOC into a premier S&T information organization from a documentation centre. The existing 21 sections and a few projects were reorganized into eight divisions, two units and a cell. Graphic Arts & Printing Unit was transferred to the Publications & Information Directorate (PID), New Delhi, for a more effective utilization of the combined printing facilities. The S&T activities of the institute are now carried out in the following Divisions/Units/Cell: Data Service Division (DSD), Computer Services Division (CSD), National Science Library (NSL), Education & Training Division (ETD), Pilot Projects Division (PPD), Programme Management Division (PMD), Technical Support Services Division (TSS), Marketing & Customer Services Division (MCS), Translation Services Unit (TSU) and Cell for Advanced Russian Studies on Science and Technology (ARSST). Besides, the three Regional Centres of the institute continued to function from Bangalore, Calcutta and Madras.

During the year, INSDOC acquired a super-mini system with 5GB disc space, 10 PC-ATs, 35 PC-XTs, 1 Optical Character Recognition system, 2 FAX machines, 2 CD-ROM drives and 2 DTP systems along with scanners and laser printers. Besides, in order to expedite the bibliographic search, online access to international databases was established, which facilitates instant searching of more than 300 databases abroad. Manual search of bibliography was

phased out. In order to pursue one of the stated objectives of INSDOC, i.e. to act as a repository of the entire S&T information generated in the country and be a channel for providing information within and outside the country, the National Science Library (NSL) of INSDOC continued to acquire almost all the S&T journals published in India. The work was taken up on compilation of a Union Catalogue of the holdings of the S&T Conference proceeding in major Indian Libraries.

Under the S&T Document Procurement and Supply Services provided by DSD of INSDOC, a total of 14,951 orders were registered and 12,946 orders were executed from INSDOC's Hq in New Delhi and its Regional Centres at Bangalore, Calcutta and Madras. Some of the orders had to be cancelled owing to incomplete bibliographical details.

*Indian Science Abstract (ISA)* is a fortnightly publication of INSDOC, which reports the research works published in Indian scientific publications and also those of Indian scientists, published abroad. A total of about 24,000 entries were processed during the year. *Current Contents* was scanned to identify the Indian contributions to foreign journals. In all, 1500 entries were processed and included in ISA during the year. Eight hundred Indian journals were scanned. During the year 18 issues of ISA 1989 covering 17,024 entries were processed and compiled. INSDOC decided to make ISA a machine readable database from January 1990. Hence, data inputting of 1990 issues of ISA was being done using the UNESCO software package CDS/ISIS, version 2.3, from January 1990.

The first NUCSSI supplement was prepared, which contains (entries up to 1988) about 1500



new titles and 3000 holdings data of 160 major S&T institutions.

Under the NUCSSI Database Service, several outputs were generated from the database, which mainly related to catalogues of individual libraries, city catalogues, catalogues of current serials on specific subjects, etc. About 5000 pages of computer printout were generated. The database supplement was updated by adding about 750 entries for sponsor and holding data.

The second revised edition of the *Directory of Scientific Research Institutions in India* was published in December 1989, covering 1376 scientific research institutions in the country.

During the year the external cashflow increased to Rs 4.5286 million, as compared to Rs 3.4717 million in previous year. Thirty-two papers were published or presented in conferences/seminars. □

### **Build Tech 1991**

An exhibition on Building Materials & Technologies was organized by the Management Group, New Delhi, in association with the Central Building Research Institute, Housing & Urban Development Corporation and National Buildings Construction in New Delhi during 10-12 May 1991. The exhibition was inaugurated by Shri R.C.Kehar, CMD, NBCC. About 26 participants comprising building materials and fixtures manufacturers, dealers and suppliers and organizations like Building Materials & Technology Promotion Council and others put up their display.

The CBRI stall included display charts of sand lime bricks, clay flyash bricks, bricks from coal washery rejects and mining wastes, solid concrete blocks and blockmaking machine, ferroceement door shutters, prefabricated roofing, flooring systems, bloated

clay aggregates, lightweight polymer concrete & gypsum binder from phosphogypsum. Models of prefabricated roofing components with moulds and samples of clay flyash bricks, sand lime bricks, bricks from copper & zinc tailings were also displayed. Prominent visitors to the CBRI stall included Shri S.K.Sharma, CMD, HUDCO, Shri A.K. Sarkar, Director (Projects), NBCC, consulting architects and engineers who showed keen interest in the CBRI technologies displayed at the exhibition.

About 600 visitors paid a visit to the CBRI stall during the exhibition. About 80 entrepreneurs from different parts of the country showed keen interest in the calcium silicate products and desired the project proposals for setting up the plant. □

### **TRAINING COURSES**

#### **Training Course on Electroplating and Anodizing**

A one - week comprehensive training course in Hindi on Plating and Anodizing was organized by the Central Electrochemical Research Institute (CECRI), Karaikudi, during 7-11 January 1991 for the benefit of a group of 8 industrial employees from Ordnance Equipment Factory, Ministry of Defence, Kanpur.

Apart from imparting essential basic aspects of metal finishing, the course offered a working knowledge and training on the practical aspects of plating of some of the widely used metals in the plating industry such as copper, nickel, chromium, zinc, cadmium, silver and gold and also anodizing of aluminium and its alloys. Testing of electrodeposits and pollution control in plating industry formed an important feature of the training programme. Various aspects of

trouble shooting in shop-floor problems were also explained by the CECRI scientists for successful operation of the plating processes during practical training.

CECRI had conducted similar courses in Hindi earlier at Bhopal, Delhi, Aligarh, and Jodhpur. □

### **Honours & Awards**

#### **Dr T.N. Khoshoo gets Jawaharlal Nehru Fellowship**

Dr T.N. Khoshoo, former Director, National Botanical Research Institute, Lucknow, and former Secretary to Government of India, Department of Environment, has been awarded Jawaharlal Nehru Fellowship by the Jawaharlal Nehru Memorial Fund. The award carries a stipend of Rs 4,500 per month for two years and a contingency grant of Rs 15,000 per year.

Dr Khoshoo, an outstanding biological scientist is associated with the Tata Energy Research Institute, New Delhi, at present. He has been awarded Jawaharlal Nehru Fellowship to work on the project 'biomass energy'.

#### **Dr Ganesh P. Pandey**

Dr Ganesh P. Pandey, Scientist El, Organic Chemistry II Division of the Indian Institute of Chemical Technology, Hyderabad, has been selected for the B M Birla Science Prize for the year 1990 in the field of Chemical Sciences. The award carries a certificate and a sum of Rs. 25,000.

#### **Dr J.S. Yadav**

Dr J.S. Yadav of the Indian Institute of Chemical Technology, (IICT), Hyderabad, has been given Dr S. Husain Zaheer Young Scientist Award for the year 1990. The award given by Dr S. Husain Zaheer Foundation Trust, carries a citation and a sum of Rs 5,000 and

is given to a scientist below 40 years.

### Dr Prakash V. Diwan

Dr Prakash V. Diwan of IICT, Hyderabad, has been awarded the P.P. Suryakumari Prize for his work in the area of *Diabetes mellitus* by the Indian Pharmacological Society. The prize has been awarded for the best paper entitled 'Influence of non-steroidal anti-inflammatory agents on chlorpropamide induced hypoglycemia in rats. □

### PATENTS FILED

1266/DEL/90: A process for the manufacture of non-precious metal oxide anodes doped with platinum group metal oxide for electrochemical processes, S.K. Rangarajan, S. Krishnamurthy, P. Subbaih, K. Asokan, K. Subramanian and V. Arumugam — Central Electrochemical Research Institute, Karaikudi.

1267/DEL/90: A process for the conversion of methane to ethylene oxide, V.R. Choudhary, S.D. Samsare and A.M.R. Rajput — National Chemical Laboratory, Pune.

1268/DEL/90: An improved process for the oxidative conversion of methane to higher hydrocarbons using rare earth metal promoted MgO catalysts, V.R. Choudhary, V.H. Rane, S.T. Chaudhari and A.M.R. Rajput — National Chemical Laboratory, Pune.

1269/DEL/90: An improved process for the preparation of 2, 2-dimethyl-5-(2, 2-dimethylphenoxy) pentanoic acid known as gemfibrozil, A.V. Rama Rao, M.N. Deshmukh and A. Ilangoan — Indian Institute of Chemical Technology, Hyderabad.

1270/DEL/90: A process for the preparation of composite catalyst containing rare earth and calcium

oxides useful for the oxidative conversion of methane to higher hydrocarbons in presence of free oxygen, V.R. Choudhary, A.M.R. Rajput, V.H. Rane and S.T. Chaudhari — National Chemical Laboratory, Pune.

1271/DEL/90: An improved process for the oxidative conversion of methane to higher hydrocarbons using composite catalysts containing oxides of rare earth and calcium, V.R. Choudhary, A.M.R. Rajput, V.H. Rane and S.T. Chaudhari — National Chemical Laboratory, Pune.

1272/DEL/90: An improved process for the preparation of 5,8-dihydro-1-naphthol, A.V. Rama Rao, M.K. Gurjar, S.V. Joshi and S.S. Simhadri — Indian Institute of Chemical Technology, Hyderabad.

1274/DEL/90: A process for the preparation of sorbent extrudes useful for high temperature desulphurization of coal burning gases, J. Borgohain, B.P. Baruah, N.N. Dutta, L. Borah and B. Mazumdar — Regional Research Laboratory.

1277/DEL/90: An improved process for the preparation of 5-methoxy-2- (3, 5-dimethyl-4-methoxy-2-pyridinyl) methyl sulfinyl-1H-benzimidazole (omerprazole), A.V. Rama Rao, M.N. Deshmukh and P.V. Srinivas — Indian Institute of Chemical Technology, Hyderabad.

### ANNOUNCEMENTS

#### CSIR - IGBP Fellowships

As an outcome of the Asian Workshop on the International Geosphere Biosphere Programme (IGBP) held in New Delhi during 11-15 February 1991, the Council of Scientific & Industrial Research (CSIR), has approved the award of 10 fellowships for scientists from developing countries to work in CSIR laboratories, in IGBP related sciences. Some of the CSIR

laboratories where IGBP related researches are in progress are: National Physical Laboratory, New Delhi; National Institute of Oceanography, Goa; Centre for Mathematical Modelling and Computer Simulation, Bangalore; National Chemical Laboratory, Pune; Indian Institute of Chemical Technology, Hyderabad; Industrial Toxicology Research Centre, Lucknow; National Botanical Research Institute, Lucknow; National Geophysical Research Institute, Hyderabad; National Environmental Engineering Research Institute, Nagpur; and Centre for Cellular & Molecular Biology, Hyderabad.

The fellowship will be tenable in CSIR research laboratories/institutes in India, at monthly stipend of Rs 1800 per month for the first two years and extendable for 3rd year with Rs 2100 per month. In case of Engineering and Medical disciplines, the stipend will be Rs 2400 per month for first two years and Rs 2500 per month for the third year. No further extension is permissible. In addition, the research fellows will be entitled to subsidized accommodation.

Eligibility: Minimum qualification requirements are a Master's degree in science & technology or its equivalent. The candidate should be holding a research assignment in a university or a laboratory and should have registration for Ph.D.

Proposals can be submitted any time during the year by Vice Chancellors of Universities, Heads of Scientific Institutions, Academies of Science or such Organizations to Shri K.N. Johry, Adviser & Head, ISC, CSIR, Rafi Marg, New Delhi 110001 with a copy to: Prof. R.R. Daniel, Scientific Secretary, COSTED, 24, Gandhi Mandap Road, Madras-600025.

For application forms and other information contact either Shri K.N. Johry or the Scientific Secretary, COSTED. □

# CSIR NEWS



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VOL 41 NO 12 30 JUNE 1991



## IN THIS ISSUE

CSIR-NRDC Technologies 1989-90	137
Quick Access Information System	138
Nodules for Catalytic Control of Autoexhaust Emission	139
Effect of Substitution of Feldspar and Quartz by Glass Ceramics and Sillimanite Sand in Por- celain Composition	140
CGCRI develops Thermally Efficient Metal-cladded Ceramic lined Portable Stove	140
Biochemical Nature of the Uterine Sialic Acid Binding Agglutinins and Their Physiological Functions	141
Sir Andrew Huxley visits CCMB, Hyderabad	142

Use of geotextiles for better roads (top) and laying of bituminous surfacing with a paver – A report or CRII R&D activities for 1989-90 appears on p.134.

## R&D Highlights: 1989-90

The major R&D activities of the Central Road Research Institute (CRRRI), New Delhi, during 1989-90, pertained to: traffic and transportation (planning, environmental control and road safety), geotechnical aspects of roads (landslide and other problems related to slope stability, use of geotextiles in road construction), rural roads including planning methodologies, stabilization of soil using low-grade materials, materials & mixes and construction techniques for rigid pavements, bituminous pavement materials and mixes for improving their durability through additives, use of anti-oxidants and anti-stripping agents, rating and rehabilitation of existing bridges and related studies in regard to expansion joints and corrosion effects, road management and evaluation studies, and development of pavement performance data for establishing pavement degradation models.

There was an increased demand for the services of CRRRI for the solution of technical problems faced by the road and the airport departments of central, state and local governments as well as by public and private undertakings. The institute handled 41 consultancy assignments, of which 20 were completed. Some of these assignments were: Planning of rapid mass transport system for Delhi, Transportation studies for Jamshedpur and Surat, Master plan for improvement of roads in Delhi, Analysis and control of landslide at several locations in the country and Improvement of roads in various states. The cash flow from consultancy, calibration and testing services amounted to Rs 15.39 million.

A brief account of the activities of the various R&D Divisions of the institute during 1989-90 is presented here:

### Geotechnical Engineering

Laboratory and field experiments in the area of Geotechnical Engineering showed that stone column acts as an efficient drain and can be used to improve the load bearing characteristics of soft clays having low undrained shear strength. It was possible to reduce the diameter of the stone column below 6D depth or use sand instead of costly stone for the lower part of the column. Based on this a concept of composite column was developed.

On the basis of test results, a chart was developed showing the relationship between modulus of elasticity and confining pressure at various relative densities for all types of sands.

As a part of its studies on the control of landslides, the institute prepared a hazard zonation map evaluating the potential stability and instability of hill slopes along Kathgodam - Nainital state highway.

Field and laboratory experiments indicated the use of coir-geogrid to be quite effective in preventing the surface erosion on natural as well as man-made slopes.

Periodic observations of experimental stretches constructed in the states of Gujarat and Maharashtra showed that stretches with geotextiles give better performance.

Remedial measures were suggested for a few landslide locations in the states of Nagaland, Himachal Pradesh, Uttar Pradesh and Sikkim.

### Soil Stabilization & Rural Roads

In the area of rural road construction, semi-field trials were continued using tractor towed agricultural implements for different road construction operations. A preliminary design for tractor towed vibratory roller (oscillatory type) was designed and a prototype model was being fabricated.

For developing a comprehensive planning methodology for rural roads, further refinements were made in the planning model. Research work was in progress for developing methodologies for generating a thorough route which would be beneficial for introducing the bus service in rural areas and for connecting the villages to several markets instead of only one market centre, as provided in the earlier model.

Studies on the stabilization of sandy soil with magnesium oxychloride cement as an alternative binder gave promising results. Further studies on the durability aspects of stabilized samples of desert sand were in progress. Under the programme on utilization of industrial waste in road construction, research efforts were made on the stabilization of alluvial soil. With the use of sintered fly ash light weight aggregate (SFALA), it was found that weaker and softer aggregate could be used purposefully in the lower layers of a road.

A collaborative R&D project was initiated with the National Thermal Power Corporation (NTPC) for exploring the possibilities of utilizing the various types of ashes in road work. Similarly, with a view to developing some energy efficient techniques/implements, another research project was taken up to compute the energy require-

ments for labour component in rural road construction.

### Flexible Pavements

Under a scheme sponsored by Roads Wing, Ministry of Surface Transport, a draft report was submitted by the institute, related to the development of Benkelman beam deflection method for evaluating structural capacity of existing flexible pavements. A tentative model relating to the characteristics of deflection to other variables has been suggested in the report.

A computer programme was developed specifically for the evaluation of flexible airfield pavements in terms of PCN. For more accurate analysis of granular pavements, computer studies on analysis of stresses and strains in flexible pavements were nearing completion. Under a research scheme on choice of surface courses for different conditions of traffic, terrain and rainfall, the performance evaluation of a test track, constructed in Gujarat in early eighties, was carried out. After evaluation of more than a dozen anti-stripping chemicals, the guidelines for the use of anti-stripping agent was formulated and two Indian standards were prepared for premixed and sprayed work.

A relationship was developed between physical and chemical characteristics of paving grade bitumens.

Work on carbon black and carbon fibre reinforced bituminous binder in road construction concluded that bitumen up to 8% can be conserved with better mix properties. Based on the laboratory studies, bitumen emulsion was recommended for use on an airfield located at high altitude to rejuvenate the weathered surface. Studies showed that the metal complex modified bituminous binder imparts a

longer service life to flexible pavement.

### Rigid Pavements

In the area of rigid pavements, an experimental roller compacted concrete pavement was constructed with improved riding quality and surface texture, using power dowels. Further studies indicated that dummy construction joints may not be needed for this type of paving technique. Besides, different types of dowel bar assemblies were designed and fabricated for studying the joints in PCC pavements. Further studies were made with another set of specimens of OPC & PPC to get improved surface finish for cement concrete roads. Performance studies carried out on the collaborative test-track of fibre reinforced concrete pavements for use by tracked vehicle at Ahmednagar indicated that the impact of loading and abrasion is more effectively taken up by fibre reinforced concrete pavement in comparison to PCC. Studies were carried out to make use of locally available aggregate for economic and speedy construction of concrete pavements. Semi-field studies were continued on the use of granulated blast furnace slag (GBFS). Different proportions of lime-GBFS concrete were being investigated for different categories of pavement. Semi-field trials were carried out using magnesium phosphate cement mortar for repair of pot holes and cracks. Studies were being made on the use of MRC concrete for repair of large craters.

### Roads

The sponsored study on spectrum of axle loads on highways to assess the prevailing situation of axle loads and traffic pattern on Indian Highways was completed and a final draft report submitted to the Ministry of Surface Transport. As

a part of development of needed infrastructural facilities for pavement evaluation, three sophisticated instruments, namely falling weight deflectometer, dynamic deflection device and La-croix deflectograph were made operational. Facilities were being developed for production of small element high strength concrete blocks to be used for paving typical areas such as dock yard and container terminal. Field studies on lateral placement of vehicles on roads were taken up at a number of urban and non-urban road sites.

Studies were continued on skid resistance of pavements and a handbook on the use of portable British Pendulum tester was being prepared. Further studies on water bound construction using large size triaxial apparatus were undertaken.

Recommendations were made on improvement of roads in the Master Plan of Delhi, design of haul road of TISCO open cast mine, West Bokaro, and specifications for road pavement in high altitude and snow-bound area of Charduar-Tawang road.

### Bridge Engineering

In the area of bridge engineering, laboratory studies on synergetic effect of phosphonocarboxylic acid and sodium nitrite as inhibitors in zinc rich organic paints showed that organic zinc rich epoxy polyamide top coat further increases the degree of protection. Condition survey of expansion joints of some bridges in Delhi was continued to develop design of three improved types of expansion joints for highway bridges to cater for thermal movements up to 40 mm. A software was developed for the analysis of highway bridges. Studies were made on a number of bridges to ascertain the possibilities of their upgradation to 70

R loading and resurfacing of carriageway, etc.

### Instrumentation

In the area of instrumentation, field trials were conducted on pavement deflection, with the LVDT housing on an existing experimental pavement stretch. Working on the development of axle mounted system for measuring riding quality of pavement, an integrator unit with least count of 1.5 cm was developed and fabricated. Further work on the calibration of axle-mounted system with standard fifth wheel bump integrator was in progress. Dynamic testing of CAC test-track on Ghaziabad bye-pass by surface wave propagation technique was continuing.

Software on linear programming and linear regression and multiple regression was developed in FORTRAN-77 for Micro VAX

computer. Likewise, software was also developed on library information system. CPM and PERT for personal computer.

### Traffic & Transportation

For developing basic travel characteristics and traffic control devices, work was carried out on developing geometric standards for design of cycle tracks. Speed flow studies of uniform type traffic was being planned to examine feasibility of traffic segregation on carriageways as per modes of travel such as car, two wheelers and buses and trucks, etc. Studies on traffic flow characteristics of roads in urban areas of different cities was taken up to evolve growth trends of traffic on more systematic basis. Likewise, study of the behaviour of traffic at intersections under mixed traffic conditions with or without control devices was in progress.

Considerable research efforts were devoted to the understanding of speed flow relationship on non-urban roads. A study was taken up to develop traffic and transportation flow data base for road system in urban areas. Data on goods traffic movements were being collected from 15 cities of varying sizes to analyze the flow characteristics of goods traffic in urban areas.

Travel data of Bombay Metropolitan region were investigated for studying the modal split characteristics for work journeys. The analysis indicates that besides income, other factors also govern the modal split.

Work was also carried out on the socio-economic and travel characteristics of industrial workers in Bombay Metropolitan Region.

Evaluation of selected public transport routes in Delhi was carried out for evolving methods of maximizing the efficiency of operations.

For planning transport system of Delhi, transport models have been developed. Attempts were made to develop transport model for medium size cities such as Jamshedpur and Surat.

Towards developing criteria for evaluation of alternative transport network, a study was undertaken for the planning of mass rapid transit systems for Delhi Urban Area.

Studies were in progress to evolve a standard frame work for economic evaluation of highway projects. A draft report for evolving capacity standards for urban roads in plain areas for Indian conditions was prepared. These standards are directly related to type of road section and desired/prevaling level of service. Further work was in progress to refine and validate the Traffic Simulation Model already developed and to apply the model in some practical case studies.

Van equipped with instruments for monitoring air pollutants





### Environment and Road Safety

A study on vision requirements for motor vehicle drivers under dynamic conditions confirmed that no definite relationship exists between the static visual acuity of a driver and his vision capabilities which he actually possesses under driving condition. A prototype of Driver Reflexes Test System developed in collaboration with the Punjab Tractors and NRDC, was evaluated for its performance for incorporating improvements in the subsequent units. On the basis of comprehensive studies, norms were established for certain psycho-physical and psychological traits desirable for Indian drivers. A study on impact of speed breaker on traffic noise safety revealed that scientifically designed speed breakers generate less additional noise as compared to ill designed humps. Preliminary experimentation on the development of suitable thermoplastic road marking material as a substitute for conventional road marking paint was continued.

Survey of Interstate buses plying from ISBT at New Delhi was carried out to assess the extent of pollution caused by engines of heavy diesel vehicles of different makes. Study on road traffic noise levels on some important arterials in Delhi and Bombay indicated that the existing noise levels in both the metropolitan cities exceed the acceptable noise level. Studies were undertaken to measure noise exposure level of different class of individuals and noise emission level of vehicles at different speeds. Likewise, a study was initiated to evaluate the effect of traffic pollution on the health of traffic policeman controlling the traffic.

### Workshop

A bump integrator unit was fabricated to measure the road unevenness. A modified version of

transverse profilograph was fabricated.

### Training Courses

The institute organized eight training courses for in-service personnel; 154 trainees attended these courses. Also, the institute was entrusted by ESCAP to conduct

training courses on optimal standards for Design, Construction and Maintenance of Rural Roads under the ESCAP project —The Development of Infrastructure for Rural Roads. Two such courses for personnel from Humid Tropics and Arid and Semi Arid Tropics areas were conducted during the period. □

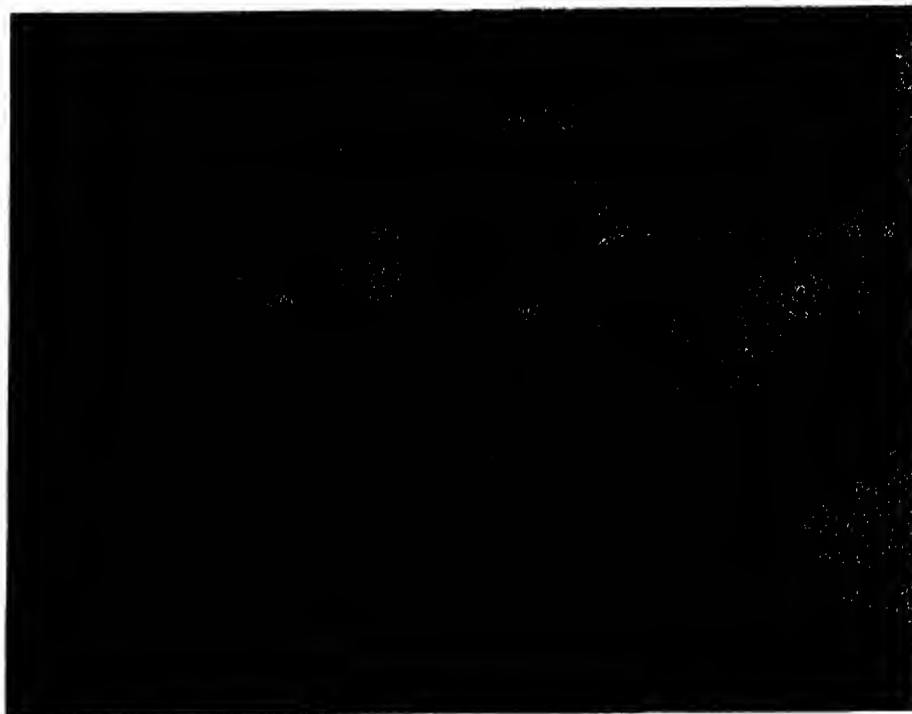
## CSIR-NRDC Technologies: 1989-90

The annual report of the National Research Development Corporation (NRDC) for the year 1989-90 shows that the Corporation was assigned 40 processes during the year, which included nine from CSIR laboratories. Of the 92 new licence agreements concluded by NRDC, 80 pertained to CSIR technologies, and eight out of the 10 new processes which went into production were from CSIR laboratories.

The CSIR processes assigned to NRDC were on: Crystallized coating for mild steel and stainless steel (CGCRI, Calcutta); Cu-Zn-Al shape

memory alloy (CSIO, Chandigarh); Black chromium plating (NAL, Bangalore); Direct reading current meter, Electro bathy thermography, Wind recorder and Automatic weather station (NIO, Goa); Flexible graphite tapes and sheets (NPL, New Delhi) and Carbon paper (RRL, Jorhat).

New licence agreements pertaining to the following CSIR products/processes were concluded: Bored compaction piles (3 parties), High draught continuous kiln (8), Corrugated roofing sheets from coir waste/wood wool (1), Improved burning of lime stone (1),



A view of the fly ash brick making machine based on the technology developed by CFRI-Dhanbad

Mini climbing crane (1), Skirted granular piles (1) and Silicate based water proofing formulations (1) (CBRI, Roorkee); Anti-corrosive treatment for steel reinforced bars (2), Copper plating on stainless steel (2), Ion-selective electrodes for silver, cupric and chloride ions (1), Lead-acid storage batteries (2), Magnesium silver chloride water activated batteries (1), Nickel cadmium batteries (vented type) (1), Magnesium cuprous chloride water activated batteries (1) and Zinc ethyl silicate primer (1) (CECRI, Karaikudi); Microprocessor-based electronic telephone exchange (3) (CEERI, Pilani); Fly ash bricks (2) (CFRI, Dhanbad); Garlic powder (1) (CFTRI, Mysore); Glass electrodes for pH, pNa and pK measurements (1), Heat wheel (rotary regenerator) for waste flue gas temp 860 (1), High alumina ceramics (1), Single fired matt glazed ceramic tiles for flooring and facing (1) and Sodium silicate from rice husk ash (1) (CGCRI, Calcutta); Acrylic resin emulsion as binder 'Binder RS' (1) (CLRI, Madras); Rescalite (1) (CMRS, Dhanbad); Electrospot testing kit for ferrous and non-ferrous alloys (1) and Ultrasonic hardness tester (1) (CSIO, Chandigarh); Monocrotophos (2), Cardanol and other products based on cardanol and cashewnut shell liquid (1), and Re-refining of used IC engine crank case oil (1) (IICT, Hyderabad); Foil type resistance strain gauge (1) (NAL, Bangalore); Friction welding machine (1) (CMERI, Durgapur); Can sealing composition based on nitrile rubber (1) and Ethlon (1) (NCL, Pune); Electrolytic manganese dioxide (1), Non-ferrous metal powder (1), Zinc oxide from zinc waste such as zinc ash/zinc hydroxide (1) (NML, Jamshedpur); Flexible graphite tapes and sheets (2) (NPL, New Delhi); Synthetic iron oxide black and red (1) (RRL, Bhubaneswar); Direct copy paper (1), Paper slate (2), Phosphamidon

(1), Thermographic paper (2) and Mini cement plant (1) (RRL, Jorhat); Bottling of coconut water (1) and High pungent fraction and colour from Indian spice oleoresin (1) (RRL-Trivandrum); FRC manhole covers (light & heavy duty) (2), Ferrocement manhole covers (heavy duty) (3) and Precast ferrocement bins (8) (SERC, Ghazilabad); and FRC manhole covers (2) (SERC, Madras).

The CSIR processes which went into production through NRDC were: Electrochemical sensors for Br, I, CN and Hg monitoring, Calcium chromate pigments and primers and Zinc alloy anodes for cathodic protection (CECRI, Karaikudi); Potassium nitrate (CSMCRI, Bhavnagar); Sodium silicate from rice husk ash, and Thermal conductivity tester (CGCRI, Calcutta); Acoustic liquid fuel

burner (RRL, Bhubaneswar); and Corrosion meter (NAL, Bangalore, CECRI Extension Centre and CECRI Unit in Madras).

Some of the major CSIR technologies licensed by the Corporation during the year involving industrial projects with capital costs in the range of Rs 5-100 million were: High alumina ceramics, Fly ash bricks, nickel cadmium batteries, electrolytic manganese dioxide, cardanol and cashewnut shell liquid based surface coatings, high pungent fraction and colour from spice oleoresins, monocrotophos and phosphamidon. These technology licences involve payment of lumpsum premia amounting to Rs 1.9 million. Substantial royalties are also expected from these technologies in the coming years. □

## Quick Access Information System

Access to authentic information is an essential prerequisite for any good reportage, all the more so in scientific reporting. For not only should a news report about a new discovery or new research be readable, it should also present facts without distortion. Unfortunately the science writer in India has always been handicapped by the lack of easy and timely access to information on research activities of R & D institutions. To fill in this gap, vital for better spread of knowledge, the Council of Scientific and Industrial Research (CSIR) has launched an information data base system called the Quick Access Information System (QAIS). The QAIS is based on a computerized data base created on the basis of inputs from the different CSIR laboratories which is periodically updated. All such updated information about the research activities in the CSIR laboratories is contained in a cassette, and a copy of it is provided to each laboratory

A prospective user can simply call at the nearest CSIR laboratory and get information about R&D work going on in any CSIR laboratory

The QAIS can provide information not only about research on any particular topic being pursued in different CSIR labs but also about the research activities of any particular CSIR scientist or of any particular CSIR laboratory

The QAIS was launched at a workshop in New Delhi on 20 April 1991 with a hands-on demonstration for media persons, science writers and scientists.

Dr S.K. Joshi, Director General, CSIR; Dr A.P. Mitra, former Director General CSIR; Dr G.P. Phondke, Director, Publications & Information Directorate, New Delhi, and Shri Vijay Tendulkar, renowned playwright and journalist, addressed the participants. The various aspects discussed included: Importance of science communication in creating awareness amongst the masses;

SUBJECT CODE : DRPH LAB CODE : DRI\_LU PROJECT CODE  
CH-5/20 RECORD NO.6

NAME OF PROJECT Gugulipid

SCIENTIST NAMES Nityanand S; DOB April 11, 1929;  
M.B.B.S.,M.D.; Research Papers-115;  
Patents Filed - 1; Technical Reports-30

Kapoor NK

RC APPROVAL DATE: 01/03/76

Gum resin of Commiphora mukul is extensively used in Ayurveda under the name Guggulu. A standardised fraction of guggulu, designated as gugulipid, has been developed as a potent hypolipidaemic agent. Gugulipid is comparable in efficacy but better tolerated than the synthetic drug clofibrate.

The lipid lowering activity is due to a number of steroids present in the fraction. Presently gugulipid is being marketed under the name Guglip by Cipla Ltd., Bombay and has also been licenced to Arkopharma of France for marketing in EEC countries.

WHETHER FUNDAMENTAL : J. WHETHER APPLIED : J.  
WHETHER EXPLORATOR : J. WHETHER SURVEY : J.

ORIENTATION DEVELOPMENT :

Drug development from traditional remedy.

IMPACT QUANTIFICATION :

Hyperlipidaemia is a widely occurring malady all over the world. Gugulipid is likely to be well received by the hyperlipidaemic patients as the existing drug; clofibrate, is not well tolerated.

COLLABORATORY/SPONSOR

CDRI project

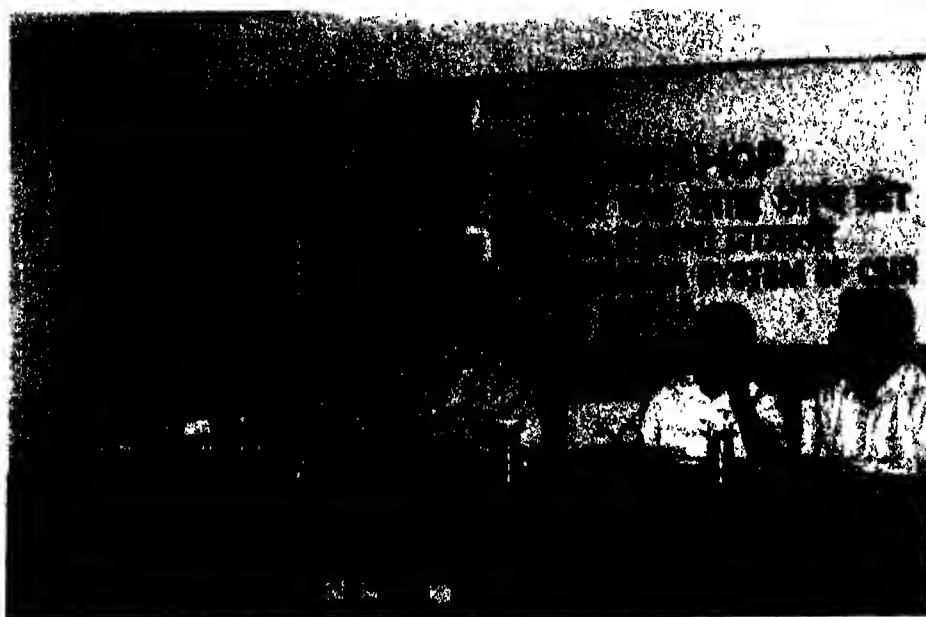
STATE OF ART

Gugulipid is a new drug developed and released for marketing in India and EEC countries. Other hypolipidaemic agents available are associated with side effects.

MEDIA REFERENCE

- (i) Nityanand S/Kapoor NK/Indian J. exp. Biol. 11, 395 (1973).
- (ii) Nityanand S/Kapoor NK/Indian J. Pharmacol. 106 (1975)
- (iii) Nityanand S/Asthana OP/Agarwal SS/ Gupta PP/Tangri AN/Dev S/Puri V/ Dhawan BN/Abstr. World Congr. clin. Pharmacol. Therap. London. No.0667

A sample of an output from QAIS



Shri Vijay Tendulkar delivering his address on 'Creative Writing', at the Workshop on Quick Access Information System of CSIR for the Mass Media. Seated on the dais (from left) are Shri Omesh Saigal, Dr S.K. Joshi and Dr A.P. Mitra

Role of databases in science popularization; and Creative writing. Shri Omesh Saigal, Joint Secretary (Adm.), CSIR, gave a video presentation describing QAIS and its utility to mass media. A panel discussion was also held. □

## Nodules for Catalytic Control of Autoexhaust Emission

Large quantities of manganese nodules discovered in the Indian

Ocean are the source of many valuable trace metals. These nodules essentially consist of a siliceous matrix into which metals such as manganese, iron, nickel, cobalt, etc. are finely dispersed. In addition to this, the large surface area exhibited by the nodules make them useful as natural catalysts. The Regional Research Laboratory (RRL), Bhubaneswar, has for the first time in India, undertaken several programmes to investigate the performance potential of these nodules for catalytic control of autoexhaust emission. Work at RRL-Bhubaneswar has established that carbon monoxide and methane, poisonous emission gases from many petrochemical industries and automobiles can be converted to carbon dioxide at lower temperatures. The findings are of great significance for industry for the control of environmental pollution. One major advantage is that catalytically spent nodules can be further processed for recovery of metal values and some of the physical

changes taking place during the catalytic processes prove beneficial for subsequent metal recovery. ▢

### **Effect of substitution of Feldspar and Quartz by Glass Ceramics and Sillimanite Sand in Porcelain Composition**

The major phases present in a porcelain are quartz, mullite (primary and secondary) and a vitreous phase. Quartz, an important constituent in conventional triaxial porcelain composition, offers many advantages with respect to vitrification process, viscosity of the glassy phase, development of an appropriate microstructure, etc. However, the unreacted quartz in the fused body adversely affects the thermo-mechanical properties. Feldspar, on the other hand, acts as fluxing constituent and provides the glassy phase in the microstructure. Presence of a glassy phase leads to reduction in elastic modulus, strength, toughness and spall resistance.

The thermal expansion of the phases differs and for the crystalline phases the expansion along the crystallographic axes is not the same. As a result, stresses are developed at the glass-crystal interfaces when a body is cooled down after firing. A sharp increase of expansion due to polymorphic transformations of free quartz (or cristobalite) also takes place at the respective transformation temperatures, 573° and 200°-280°C. The amount of stress increases with grain size and when the stress is excessive, microcracks occur commonly at grain boundaries and sometimes within the grains, which affect severely the thermo-mechanical behaviour of conventional porcelain.

Shri K.N. Maiti, Scientist-in-Charge, Central Glass & Ceramic Research Institute's Khurja Centre, studied properties of por-

celains containing crystallizing glasses and beach sand sillimanite in place of feldspar and quartz, respectively. He found that on gradual replacement of quartz by sillimanite the amounts of residual quartz and glassy phases decrease, sillimanite particles remain unreacted and well dispersed in the microstructure. Mullite content remains almost unchanged. The viscosity of the liquid phase remains low and favours densification and elimination of pores. As a result, the fracture strength of the new material increases by around 26%, elastic modulus by 26%, toughness by 31%, micro-hardness by 5 to 10% and the resistance to abrasion by 10%. The thermal expansion is reduced primarily due to elimination of quartz and the resistance to thermal shock increased by 50%.

Shri Maiti also observed that by replacing feldspar with glass-ceramic forming frits, in the quartz free sillimanite containing

material, the strength and toughness improve by around 70.0% and 49.0% respectively, and the modulus by 48.0% in comparison to that of the conventional porcelain.

Due to the presence of cordierite in the microstructure the thermal expansion is further reduced and the thermal shock resistance increases by around 67%. These improvements were attributed to the decrease in the amount of glassy phase and appearance of cordierite in its place, in addition to the favourable factors mentioned earlier.

It was possible to eliminate to a large extent the inherent defects in the microstructure of a conventional porcelain, and substantial improvement in the mechanical and thermal properties were achieved.

For his thesis based on these studies, Shri Maiti was awarded Ph.D. degree in chemical technology by the University of Calcutta. ▢

### **CGCRI develops Thermally Efficient Metal-clad Ceramic-lined Portable Stove**

In India there is a great demand for the use of portable type of chulhas; especially by the migratory population, slum dwellers and those living in temporary and small hutments.

Various designs of wood fired chulhas have been developed by Technical Back-up Units (TBU) under National Programme on Improved Chulhas (NPIC) launched by Department of Non-Conventional Energy Sources (DNES), New Delhi. At present many small scale manufacturers are making and marketing such chulhas of approved design by DNES. To ensure durability, chulhas are made from mild steel, cast iron etc. There are some defects in these types of chulhas, viz. Chulhas are not properly insulated; The temperature of the

outer surface is high and ranges between 110°C and 200°C resulting colossal heat losses; and Thermal efficiency ranges between 23 to 28% only.

As a result of R&D work carried out by TBU at the Central Glass & Ceramic Research Institute's Khurja Centre, two models have successfully been developed and named as Sona and Sona-super. The power ratings of the stoves are in the range of 1.2 - 1.5 kW and 1.8 - 2.0 kW respectively.

The essential components of the stoves are: ceramic liners of appropriate shape and size; cast iron grate of around 150 mm dia and a metal clad structure. The ceramic liner is wrapped with thin aluminium sheet of 42-52 SWG before metal cladding. The annular



Ceramic - lined portable chulha — Sona Super

space between the ceramic liner and metal sheet is filled with rice husk ash (RHA) of compaction density (bulk density) around 0.35 to 0.40 g/cc for insulation purpose. The top and bottom portion of the annular space is properly sealed with a mixture of cement, fireclay and water in the ratio of 1:1:0.5 to avoid leakage of the insulating fill. The weight of the stove is about 13-14 kg.

The novel features of the stove are: The requirement for primary and secondary air supplies and their ratio have been optimized; The dimensions of distributor for separate entry of primary and secondary air inside the burning chamber for adequate control of the speed of flame as well as to ensure maximum possible heat transfer to the vessel have been standardized; To improve combustion efficiency, size and shape of fire box have been standardized; To maximise the overall energy efficiency, the size and shape of ceramic liner as well as the dimension of the stove/chulha have been optimized; and To reduce the temperature of the outer surface of the stove/chulha, low-cost insulat-

ing material has been used for insulation.

The performance of the stove is superior to existing one. The thermal efficiency is about 45% and the emission characteristics are within the limit.

### Biochemical nature of the uterine sialic acid binding agglutinins and their physiological functions

A group of sialic acid specific agglutinins (SAS) has been isolated from the rat uteri at different stages i.e. proestrus (P), estrus (E) and diestrus (D) of the estrous cycle and purified by affinity chromatography on fetuin-sepharose 4B column.

Smt Indrani Chakraborty, while working at the Indian Institute of Chemical Biology (IICB), Calcutta, studied the biochemical nature of the uterine sialic acid binding agglutinins and their physiological functions. They are glycoproteins in nature with molecular weights varying from 30-34 kd. Comparative studies focussing on their sugar binding properties reveal that these ag-

glutinins bind specifically to sialic acid and sialoglycoproteins; however the minimum sialic acid need for 50% inhibition of haemagglutination varies stage specifically: D-SAS >P-SAS >E-SAS. Likewise, the binding affinities calculated from Scatchard analysis using 4-methyl-umbelliferyl sialic acid as the ligand suggest the same pattern.

Circular dichroism spectrum of the three agglutinins indicate differences in the secondary structures of the proteins. Immunodiffusion study shows that P-SAS and E-SAS are antigenically identical whereas D-SAS is partially related.

A comparison of their physiological functions indicate that though possessing similar biochemical properties, the SAS proteins differ functionally. All SAS have sperm binding activity and the binding is localized in the head region of the sperms. The binding activity of these agglutinins varies in the order P-SAS >E-SAS >D-SAS. They also induce sperm motility depending on the dose. At high concentration, all SAS proteins agglutinate sperms. Scanning electron micrography shows that no marked changes on the sperm surface occur on incubation of sperms with these proteins.

Studies to determine the role of the SAS proteins on mitogenesis *in vitro* indicates that all of them are capable of inhibiting *in vivo* phytohaemagglutinin (PHA) induced blastogenic response of lymphocyte and thymocytes. In absence of PHA, P- and E-SAS stimulate lymphocyte proliferation whereas D-SAS is immunosuppressive as indicated by a decline in the uptake of <sup>3</sup>H-thymidine, and further confirmed by autoradiography. Lymphocytes from pregnant rats are found to be more susceptible to the inhibition and no SAS proteins have complement like activity.

Analysis of the contents of the isolated cell types of uterus indi-

cates that all SAS proteins are localized in the epithelial cells of the endometrium. Data of *in vitro* synthesis studies also support this finding.

Reappearance of the SAS proteins activity tested by haemagglutination titre in the ovariectomized animal on estrogen administration suggests that SAS are possible estrogen inducible proteins.

Smt Indranti Chakraborty who worked under the guidance of Dr(Smt) Mridula Chowdhury of IICB, Calcutta, was awarded the Ph.D. degree in Science (1991) by Jadavpur University for her thesis based on the study. □

### Sir Andrew Huxley visits CCMB, Hyderabad

Eminent physiologist and Nobel Laureate Sir Andrew Huxley, FRS, from the Cambridge University, visited the Centre for Cellular and Molecular Biology (CCMB), Hyderabad on 12 March 1991. He delivered a lecture entitled: The Concept of Contractility.

Sir Huxley mostly worked in collaboration with the Nobel Laureate Dr Hodgkin on 'Nerve conduction'. Sir Huxley's research

work was mainly concerned with the physicochemical analysis of the fundamental phenomena involved in the excitation in a peripheral nerve fibre and during conduction of excitation along the nerve fibre. Sir Huxley has made contributions of fundamental importance to the knowledge of the intricacies involved in the contraction of a muscle fibre. In 1952, Sir Huxley developed an interference microscope for studying the muscle fibre.

## PERSONNEL NEWS

### Appointments/Promotions

At the Regional Research Laboratory (RRL), Jammu, Dr S.K. Mehta, Dr J.S. Chawla and Dr Y.K. Sarin have been promoted as Scientists F with effect from 17 April 1988, 22 July 1988 and 12 June 1989 respectively.

#### Dr S.K. Mehta

Dr S.K. Mehta (born 13 April 1938) obtained B. Tech. and M. Tech. (Chem. Engg. & Tech.) from Calcutta University and Dr Ing. (Ceramics) from Clausthal University, Germany. He joined RRL,

Jammu in February 1963 and is continuing since then.

Dr Mehta is an eminent scientist in the field of material sciences. He has established a school to carry out fundamental as well as applied work for non-metallic minerals in the laboratory. He has developed several technologies based on gypsum, borax, bauxite and limestone and commercialized these by establishing industrial units in various parts of India. His work on gypsum products has been much appreciated in India and received awards. Based on the technologies developed by him in the laboratory, five units have been set up for making different type of



plasters, such as orthopaedic, dental, ceramic, and high strength plasters. He established a Unit (first of its kind) for the utilization of geothermal energy in India. The Department at present under his guidance is working on two national missions and one thrust area project apart from other projects. He also undertakes advisory consultancy/sponsored work on mineral based industries. A Quality Control Testing Laboratory has been established by him which advises government as well as private entrepreneurs about the quality of raw materials, water, minerals and other industrial products.

Besides being nominated as a member of the National Committee on Geothermal Energy Utilization, he holds membership of various other institutions like Bureau of



Sir Andrew Huxley, Nobel Laureate, with Prof. Sharat Chandra, Director, CCMB



Indian Standards, IGCP Project No.254, J&K Geology and Mineral Development Board. He is also a member of Indian Ceramic Society.

Dr Mehta has more than 100 publications and six patents to his credit. He is a recognized examiner and supervisor of Ph.D. work for various universities and IITs in India. He has so far guided six students for the award of Ph.D. degree.

#### Dr J.S. Chawla

Dr Chawla (born 13 April 1936) obtained M.Sc. (Tech) in 1956 and Ph.D. in 1963 from the Panjab University, Chandigarh. He worked as a Lecturer at the Panjab University College, Hoshiarpur, for about one year and then joined the Forest Research Institute, Dehra Dun, where he worked in the Composite Wood Branch and Cellulose & Paper Branch on the Utilization of arecanut husk and other lignocellulosic materials. Later he worked as a Pool Officer at the Chemical Engineering and Technology Department, Panjab University Chandigarh. He joined RRI



Jammu in 1964 and organized the Cellulose Pulp and Board Section which he is heading ever since. He was made Chairman of the Division in 1975. He was instrumental in setting up pilot plants on paper board and fibre board.

Dr Chawla's work is mainly concerned with the chemistry and utilization of lignocellulosic materials for the production of useful forest products. He has studied

several materials for paper pulp, fibre boards, particle boards, composite boards, wood plastics, fuel bricks, roofing shingles, lignin based fine chemicals as well as cellulose derivatives. He has a number of processes to his credit.

One of his significant achievements has been the utilization of pine needles, a renewable forest waste, for the production of fibreboard for use as a packing material for transportation of fruits and other articles. Based on the complete technology worked out by him, a 4 tonne/day unit was set up in Himachal Pradesh on turnkey basis. He also provided consultancy for setting up small scale particle board and paper board units. He is also responsible for demonstrating the possibility of making vanillin and other fine chemicals (based on lignin) from saw dust of certain species of plants.

He has worked on the thermo-mechanical pulping using the latest high yield pulping technique, at the Swedish Forest Products Laboratory and AB Defibrator, Stockholm (Sweden).

Dr Chawla was a member of H.P. Government Forest Utilization Committee and a member of Committee for Alternate Sources for Wood Based Industry of the Government of India, Department of Environment, New Delhi. He has visited extensively large forest areas and forest based industries in India and abroad. He has also visited a number of R&D institutions and industrial units connected with paper pulp, fibre board and other wood based products in UK, USA, Sweden, Norway Germany, Denmark and Italy

He has interacted with a number of R & D and educational institutions on various projects and provided guidance to students of Ph.D., and technical institutions for their project work.

He has more than 100 publications to his credit and provided consultancy to a number of parties.

He was awarded merit increments under CSIR merit promotion scheme and was declared RRL Scientist of the year 1976.

#### Dr Y.K. Sarin

Dr Y.K. Sarin (born 20 October 1933) obtained M.Sc. in Botany from Rajasthan University (1956) and Ph.D. from Kashmir University (1972). He joined Botanical Survey of India in 1956 and later RRL-Jammu in 1960. At present he is heading Botanical Sciences Division of the laboratory.



Dr Sarin's research activities, spanning the last thirty years, cover mainly the fields of applied economic botany, floristics and forest ecology. He has made extensive studies in the areas of medicinal and aromatic plants leading to discovery of a number of plants as a source of raw materials for drug, pharmaceutical and essential oil industry, some of which have been commercialized. Notable among these are *Dioscorea deltoidea* and *Costus speciosus* (source of diosgenin), *Heracleum candicans* (source of xanthotoxin), *Silybum marianum* (source of silymarins), Indian *Datura* spp. and *Physoclainae praealtic* (source of tropane alkaloids and *Skimmia laureola*, Himalayan lichens, *Archangelica officinalis*, *Angelica glauca* and *Juniperus macropoda* as source of important essential oils and aroma chemicals. He has con-

ducted extensive field survey in various parts of India and Nepal to evaluate medicinal and aromatic plant resources. He has also made detailed studies on the structure and composition of forests in Western Himalayas.

Dr Sarin is associated with a number of government and semi-government organizations as an adviser, member of task forces and consultant. He had been Honorary Secretary of Standing Committee on forest based industries, Jammu & Kashmir; Member, Forest Utilisation Committee, Himachal Pradesh; Adviser, Nehru Institute of Foreign Trade; and Member, Scientific Advisory Committee, C.C.R.A.S. (Ministry of Health and Family Welfare). Presently, he is a member of Scientific Advisory Committee of National Institute of Ayurveda, Jaipur; Member of the Governing Body of Central Council of Research in Ayurveda & Siddha (Ministry of Health and Family Welfare, Government of India) and Co-ordinator, Joint CSIR-CSAV terrain research programme in Western Himalayas. He has provided consultancy to a number of industrial concerns dealing with drugs, pharmaceuticals, essential oils and aroma chemicals.

He visited U.S.A. in 1979 to study the latest trends in research on economic plant products and Czechoslovakia in 1989, for comparative studies on the flora of Giant Mountains and Western Himalayas.

Dr Sarin is a recognized guide for Ph.D. He has more than 120 research papers, 20 technical reports and 3 books to his credit.

### Shri P.S. Desikan retires

Shri P.S. Desikan, Deputy Director of the Central Electrochemical Research Institute (CECRI), Karaikudi, retired on 31 January 1991 on reaching the age of superannuation.

Shri Desikan (born January 1931) graduated in Chemical Engineering with a high first class from Annamalai University in 1952. He joined CECRI in 1953 and worked mainly in the area relating to technology development through bench scale and pilot plant work.



Shri Desikan devoted a major part of his career to the development of technology for magnesium metal by electrolytic route. He served as the Project Manager for the magnesium project of CECRI jointly sponsored by Government of Tamilnadu and CSIR.

As a result of this work, a new modular type of electrolytic cell for magnesium resulting in considerable energy saving was developed. Shri Desikan was first in the world to identify sea-bitterns as an economic source for magnesium. A 600 tonnes/year magnesium plant based on sea-bitterns has already started production utilizing this know-how. The plant has been set up by TIDCO at Valinokkam in Tamilnadu. Besides this, two 30 kA prototype cells of modular design for magnesium have been set up as a captive unit of the Titanium Sponge Experimental Facility of Defence Metallurgical Research Laboratory (DMRL), Hyderabad.

Shri Desikan whose main field of interest is molten-salt electrometallurgy worked on projects relating to Aluminium

metallurgy, including one to produce superpure aluminium.

Shri Desikan obtained specialized training in Electrometallurgy in France during 1964-65. He was recipient of IPB awards for the process of magnesium and potassium cryolite. He and his team received the United Nations Gold medal sponsored by World Intellectual Property Organisation (WIPO) for their meritorious invention on an improved (modular) cell for production of magnesium metal by fused chloride electrolysis. The same team also received NRDC award in 1989.

Shri Desikan also writes scientific articles in Tamil and is serving as the Honorary Editor of the Tamil Science Monthly 'Ariga Arivigal - Valarga Vigyanam' brought out by Swadeshi Science Movement. He has over 40 research papers and five patents to his credit.

### PATENTS FILED

1265/DEL/90: A process for the preparation of dry cellulose ester blend membrane for reverse osmosis, S.V. Joshi, K.J. Bhosale, V.J. Shah and A.V. Rao—Central Salt & Marine Chemical Research Institute, Bhavnagar.

1273/DEL/90: An improved process for the preparation of *cis*-5-[3-(1, 1-dimethylethyl) amino]-2-hydroxypropoxy-1, 2, 3, 4, tetrahydro-2, 3 naphthalenediol (Nadolol);  $\beta$ -adrenergic blocking agent, A.V. Rama Rao, M.K. Gurjar, S.V. Joshi and S. Simhadri—Indian Institute of Chemical Technology, Hyderabad.

1275/DEL/90: An improved process for the preparation of 1-ethoxy- or 1-cyano-5-substituted-11-methyl-10-aza-4,6,12-trioxatricyclo (7.2.1.0<sup>2,8</sup>) dodec-10-ene, A.V. Rama Rao, M.K. Gurjar, T.R. Devi and K.G. Venkataramanalah—Indian Institute of Chemical Technology, Hyderabad.

# CSIR NEWS



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A view of the CIPLA's Etoposide plant based on IICT technology. A report on R&D activities of IICT during the period 1988-90 appears on p.146

## IN THIS ISSUE

CIMAP celebrates its Annual Day 149

Institutional Building Technology:  
Centre at RRL, Bhopal 150

Centre for Plant Molecular Biology at  
NBRI 151

Low-waste Chrome Tanning Salts 151

Studies on fluidized bed reactors for  
fine powder systems 151

Field Demonstration on Large Scale  
Cultivation and Distillation of

Aromatic Grasses—Palmarosa,  
Lemongrass and Citronella 152

CMRS Annual Report: 1989-90 153

International Training Programme on  
Environmental Assessment  
and Monitoring 154

## R & D Highlights: 1988-90

The major R&D projects of the Indian Institute of Chemical Technology (IICT), Hyderabad, pertain to: Drugs, Agrochemicals, Organic Intermediates, Catalysts, Ceramics and Material Sciences, Oils and Fats, Organic Coatings and Polymers, Coal Gasification, Chemical Process Development and Design, Computer-aided Studies on Simulation and Optimisation of Chemical Plants, Biological Control of Insects, Pests and Weeds, Toxicity of Pesticides, Biomineralogy, and Cellulose Products. The institute continues to interact closely with industry as evidenced by the 20 processes released for commercial exploitation, the 15 commercialized processes, and the numerous sponsored and consultancy assignments worth Rs 74.6 million during 1988-89.

A brief account of the noteworthy activities/accomplishments of the institute during 1988-90 is presented here:

### Biologically Active Compounds/Drugs

Under the project on total synthesis of anti-tumour antibiotics, synthesis of sesbanimide was completed, and work on fredericamycin-A, produced by *Streptomyces griseus*, was intensified. Work was initiated on the synthesis of cervinomycin produced by *S. cervinus* possessing strong inhibitory reactivity against anaerobic bacteria and mycoplasmas.

Studies have shown that the key compound 'MeBmt' is responsible for the activity of cyclosporin – the only immunosuppressant in current use by those who undergo organ transplants. IICT developed three different approaches for the synthesis of MeBmt. Further work for the synthesis of key compound was being pursued.

IICT is the nodal agency for coordinating R&D work in the area of drugs and drug intermediates. While the CDRI's focus is mainly on developing new drugs, IICT's programme focuses on developing innovative technologies for known drugs.

The technology for Flurbiprofen, an antiinflammatory and analgesic drug, was commercialized by FDC, the sponsor, in 1989. The technology is far superior to that in current use all over the world. This is the first fluorinated analgesic manufactured in the country and is more effective than other well-known aryl propionic acids.

Timolol maleate is a widely used anti-glaucoma agent. The product, which is exclusively imported, is an optically active isomer. A novel approach starting from D-mannose was worked out for a commercial process to obtain only one optical isomer. The project has been successfully imple-

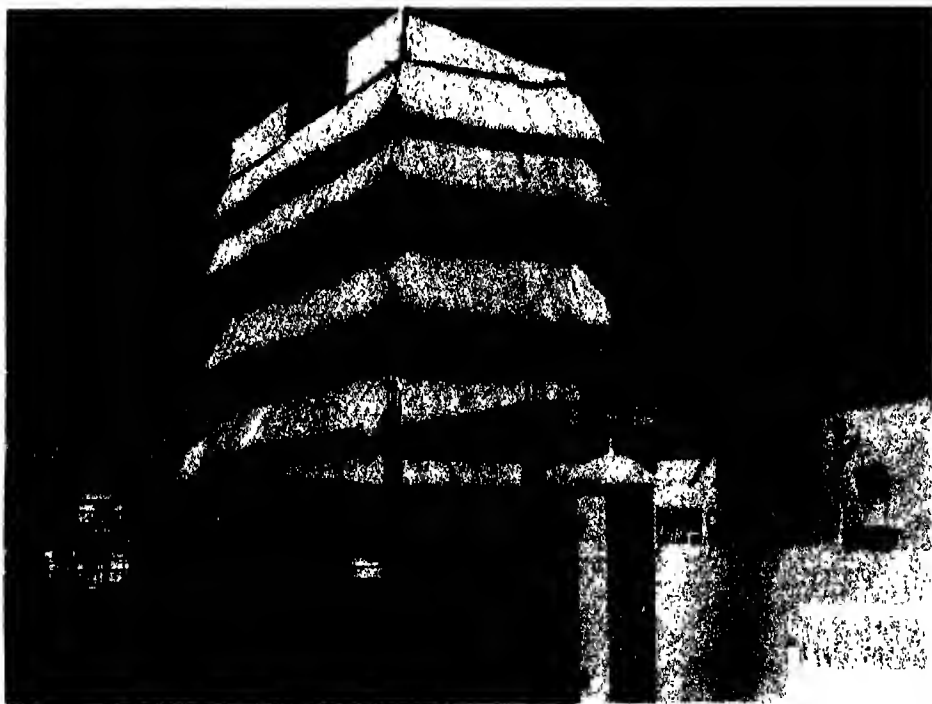
mented by FDC for commercial exploitation.

IICT developed the complete technology, starting from isolating the podophyllotoxin from the rhizomes of *Podophyllum emodi* up to its conversion to Etoposide, an antitumor agent. The technology was passed on to CIPLA for its commercialization.

The production technology for Sulbactam, a semisynthetic  $\beta$ -lactamase inhibitor, was developed starting from 6-amino penicillanic acid. The process was passed on to Unichem, Bombay.

Mitoxantrone is an anti-cancer agent used widely for the treatment of small cell lung cancer. IICT's process for the manufacture of this drug was taken up by Sun Pharmaceuticals Ltd, Bombay.

The other drugs whose processes for manufacture were developed/being developed include: Phenylephrin hydrochloride (decongestant) (project sponsored by FDC, Bombay), Diltiazem (anti-



A view of the Parsin Chemicals Ltd, who has taken up the IICT's technology for production of sodium azide

anginal) (project sponsored by Lupin Laboratories), Gemfibrozil (anti-hyperlipoproteinemics) (process passed on to Cadila Laboratories), and Astemizole (anti-histaminic) (project sponsored by Cadila Laboratories).

### Agrochemicals

During 1988-90, technologies for several pesticides were developed and released: (1) A novel process to obtain an effective insect antifeedant and insect growth regulating fraction from neem oil

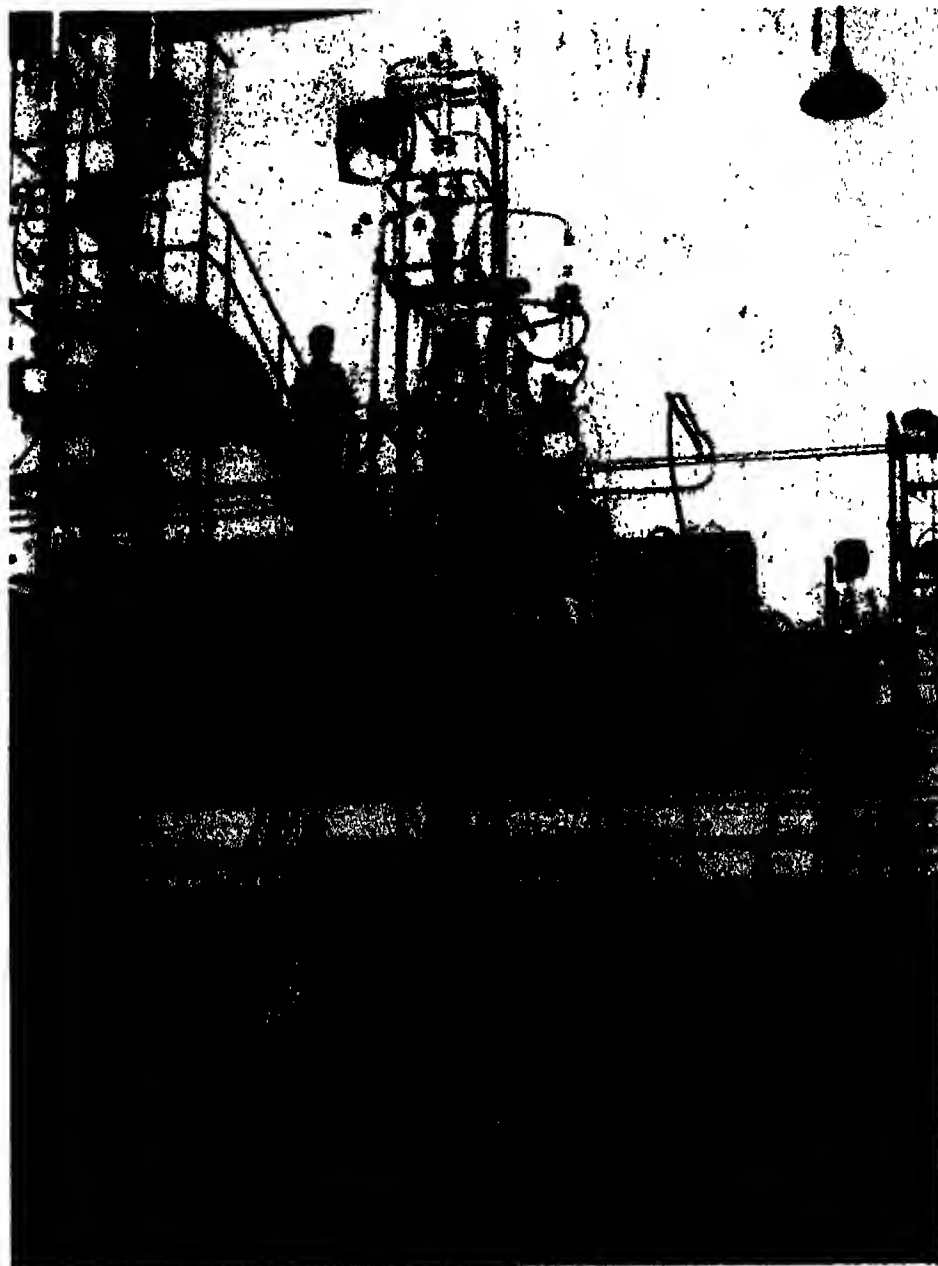
(Vepacide) was developed and provided to the sponsor, NOCIL-Bombay, for commercialization. (2) An innovative, modified process for the manufacture of chlorpyrifos, a versatile insecticide, was developed by a one-step synthetic route to the key intermediate 3,5,6-trichloropyridinol and the process know-how was provided to NOCIL-Bombay, who were setting up a plant of 300 tonnes/annum. Also, the process was demonstrated to Vantech Pesticides Ltd, Khatau Junker Ltd, Lupin Laboratories Ltd

and Sharda Agro Organo Pesticides Ltd. (3) The Hindustan Insecticides Ltd set up a plant to produce 1000 tonnes/annum Butachlor, an effective weedicide for rice. The process was demonstrated to Vantech Pesticides Ltd, who set up an integrated plant to produce Monocrotophos, Butachlor and Chlorpyrifos. (4) NOCIL-Bombay commissioned a commercial plant to produce 300 tonnes/annum DDVP based on the technology provided by the institute. The process was also released to Kanoria Agro Products Ltd, who were setting up an integrated complex. (5) The Vantech Pesticides Ltd commercialized the technology provided by IICT for Monocrotophos. IICT provided assistance to National Insecticides and Chemicals Ltd in commissioning its plant of 1 tonne/day capacity. The process has been released to six other parties. (6) Process for the pre-emergence and post-emergence herbicide, Isoproturon, was developed based on cumidine as the starting material and cumyl urea as the intermediate, and it was released to Hindustan Insecticides Ltd. (7) Process for the pyrethroid insecticide, Flucythrinate, was developed with phenol as starting material. Collection of design data was underway and the technology was to be made available to the sponsor, Gujarat Insecticides Ltd.

Other agrochemicals which were developed/being developed include: Chlorsulfuron, Carben-dazim, Carbamates, Glyphosine, Acephate and Primiphos methyl, Cyhalothrin, Esfenvalerate, Fluvalinate, Glyphosate, Chlor-thalonil, Thiodiazuron and Pen-dimethalin.

Also, IICT in collaboration with RRL-Jorhat was working on a techno-economic feasibility report for setting up an integrated pesticide complex in Bangladesh.

The technology for sodium azide, a mild detonator, was



All glass pilot plant at IICT

provided to Parsin Chemicals Ltd. The plant has been successfully commissioned. Organic intermediates, projects relating to which were completed/under implementation, include: *m*-Phenoxybenzaldehyde, Cyanuric chloride, Monochloroacetic acid, Glyoxal, Phenylacetic acid and Diethylmalonate.

### **Catalysts**

Studies were made on the development of catalysts for: fuel cells, pyrazinamide preparation, oxychlorination of ethylene, alkylation of phenol and *m*-cresol, hydroprocessing, L-Dopa synthesis, etc.

### **Ceramics and Material Sciences**

In the area of Ceramics and Material Sciences, different raw materials required for lanthanum chromite heating elements were identified. A process was developed for NTC thermistors, based on nickel-manganese-copper oxide system with better ageing characteristics, for a resistance range of 10-120 ohms. Superconducting single phase  $\gamma$ -Ba<sub>2</sub>Cu<sub>3</sub>O<sub>7- $\delta$</sub>  composition was synthesized by solid state route and a unique method of preparation of this compound by sol-gel method was developed.

### **Oil and Fats**

Under the Oilseeds Mission, a process for thermal stabilization of rice bran was developed using a specially designed steam-heated continuous stabilizer called 'Rota Disc'. The stabilizer has a throughput of 100 kg/h and is suitable for installation in 50 tonnes/day rice mills.

Other projects under the Mission related to: protein-based surfactants from non-edible oilcakes, soya lecithin, selective hydrogenation of soyabean oil, hydrogenation of mustard oil, etc.

### **Organic Coatings and Polymers**

Cyanoacrylate and anaerobic adhesives have become commercially

important because of their ability to polymerize rapidly and to give high bond strengths between a wide variety of metals. Important methyl and ethyl cyanoacrylates were synthesized; yields of high purity were obtained and manufacturing conditions standardized. Cyanoacrylates such as butyl, isobutyl and octyl were also synthesized. In the case of anaerobic adhesives, monomers such as polyethylene glycol dimethacrylate were synthesized and their anaerobic compositions were developed. The process know-how was demonstrated to two clients who were implementing the project.

With a view to finding substitutes for wood for use in buildings, composites with plywood facing and a core based on interpenetrating polymer network (IPN) of polyurethane phenolic and polyurethane polyester rigid foams were prepared. Flush doors with composites of rigid foam core and plywood facing were evaluated by CBRI as per IS specifications.

Also, new polyols based on sorbitol were developed, which can be used for preparing rigid foams varying in density from 0.03 to 0.04%. These foams do not use fluorocarbons which damage the ozone belt.

The following projects pertaining to anti-corrosive coatings and chemicals were completed/demonstrated to the clients: Design of cardanol distillation plant of 3 tonnes/day capacity along with 1 tonne/day capacity cardanol-based resin plant, two pack polyurethane resins, urethane varnishes and paints (commercialized), CNSL resins, hydrogenated cardanol process, slate paints from CNSL, etc.

### **Coal Gasification**

The Ministry of Energy, Government of India, has constituted an expert committee with representatives from CSIR, BHEL,

Department of Coal, Department of Power and PDIL to evaluate coal gasification process for power generation and to identify a suitable technology for setting up a demonstration plant based on the integrated gasification combined cycle (IGCC) power generation system. The committee recommended that the 40% ash-containing coals which are abundant in the country need testing before being considered for IGCC power generation. It also recommended the testing of the candidate coal in the 1 tonne/hour moving bed (dry ash) gasifier at IICT and 150 tonnes/hour CCDP plant at BHEL, Tiruchirappalli. PDIL India has been identified for providing TEFR for the moving bed (dry ash) gasification, based on the data generated at the IICT pilot plant and the BHEL demonstration plant. Work is being pursued.

CMPDIL-Ranchi sponsored a project on fluid bed gasification of coal for the generation of low-Btu fuel gas which can be used in place of the costly furnace oil in small and medium scale industries.

### **Hazard Study and Risk Analysis**

A group of CSIR laboratories in association with TNO of The Netherlands completed the consultancy assignment for ONGC on Hazard Study and Risk Analysis of the latter's gas processing complex at Hazira. IICT coordinated the project and the other CSIR laboratories were ITRC, CLRI, NEERI and RRL-Jorhat.

### **Computer-aided Simulation and Optimisation**

A computer programme was developed for flow in pipelines in series, using a centre implicit finite difference method. Retrograde condensation of the gas produced at Bombay High was confirmed by the programme which is based on SRK and PR equation of state and has been extended to BWRC & PR equations of state. The former gave better results.



Several computer software were developed for the chemical process industry.

### Biology

The projects in the area of Biology pertained to: Biological control of

uzifly (TNO sponsored project), Studies on *Eichhornia crassipes* for heavy metal pollution control, Biological control of insects, pests and weeds, Toxicity of pesticides, Biomíneralogy, etc.

### Cellulose Products

In the area of Cellulose Products, cable insulation paper was developed from the indigenous raw material *Pinus kesia*. The physical and electrical properties compared well with that of the imported cable insulation paper.

A cylinder mould type paper demonstration unit was successfully commissioned. Different grades of paper/board (from 60 to 250 gsm) were being made on this machine.

During 1988-90, 280 papers were published in various research journals. Sixteen patents were filed, six patents were accepted and two sealed. □

### CIMAP celebrates Annual Day

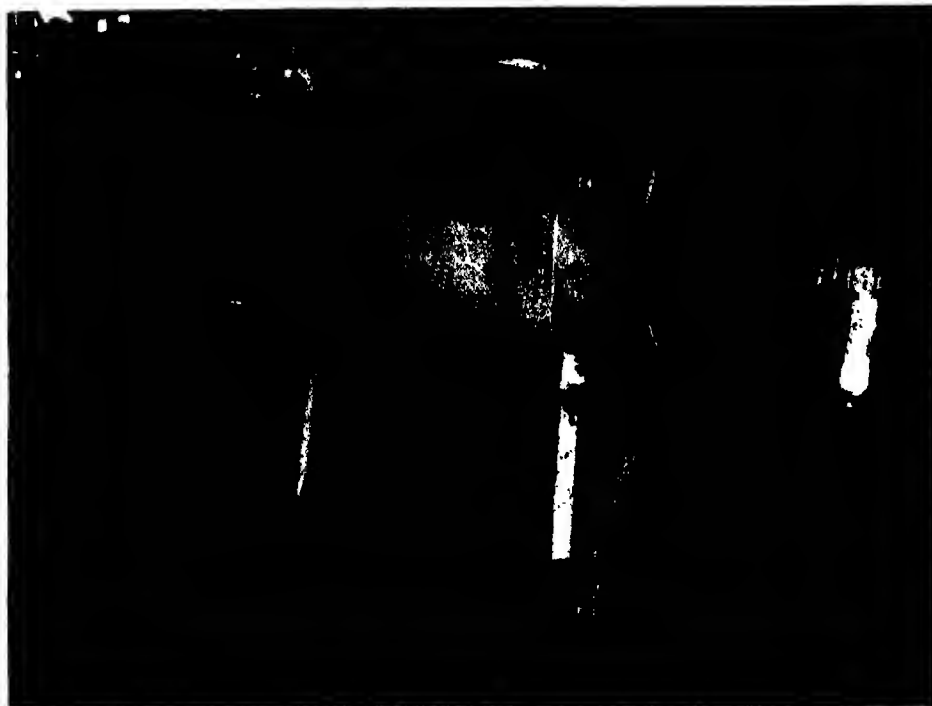
The Central Institute of Medicinal and Aromatic Plants (CIMAP), Lucknow, celebrated its Annual Day on 18 March 1991. The function was presided over by Dr M.M. Dhar, former Director, Central Drug Research Institute, Lucknow, and attended by scientists and elite of the town.

Prof. M.M. Sharma, Director, Department of Chemical Technology, Bombay University, delivered the Eighth Silver Jubilee Lecture on 'Separation processes for aroma chemicals'.

Speaking on the production of aromatic chemicals from natural products, Prof. Sharma said that the recent developments in chemical technology are directed at high efficiency column packings which also offer very low pressure drop. However, for expensive products, chromatographic separation can be done commercially, he added. Prof. Sharma further pointed out that supercritical extraction with carbon dioxide as a solvent has now become commercial for extraction of hops, and the production of many aroma chemicals is likely to benefit with this methodology.



Partition flush door made of interpenetrating polymer network (IPN)



Rota disc bran stabilizer



Dr R.S. Thakur, Director, CIMAP, delivering his address. Seen on the dais (from left) are: Dr D V Singh, Deputy Director, CIMAP, Dr M M Dhar, former Director, CDRI, Prof M M Sharma, Director, Department of Chemical Technology, Bombay; and Shri O P Virmani, Deputy Director, CIMAP

## Institutional Building Technology Centre at RRL, Bhopal

Shri S.K. Sharma, Chairman-cum-Managing Director, HUDCO, inaugurated an Institutional Building Technology Centre at the Regional Research Laboratory (RRL), Bhopal, on 9 May 1991. The Centre has been promoted by the Ministry of Urban Development, HUDCO, MAPCOST, CBRI, RRL and set up to serve the area of housing sector.

Highlighting the objectives of the Building Centres supported by HUDCO in various parts of the country, Shri Sharma mentioned that these centres have an important role in providing an interface for technology transfer between research institutes and the housing agencies. Lauding the efforts of RRL-Bhopal in taking the initiative, he mentioned that the centre shall develop entrepreneurial capabilities in promoting innovative technologies in low-cost housing sector. He expressed confidence that the state of Madhya Pradesh would benefit from the centres, and more of such centres would be set up in near future.

Shri Naresh Narad, Secretary, Housing & Environment, also addressed the gathering.

Earlier, Prof. T.C. Rao, Director, RRL-Bhopal, welcomed the dignitaries. A large number of dignitaries including Dr D.N. Misra, Director General, M.P. Council of Science & Technology; Prof. K.C. Nair, Vice Chancellor, Barkatullah University; Dr D.S. Tiwari, Chairman, M.P. Pollution Control; and Prof. J. Sengupta from MOUD attended the ceremony.

Shri A.C. Khazanchi, Deputy Director & Head Building Materials Division, RRL, proposed a vote of thanks.

An exhibition of new alternative low-cost materials, jointly organized by HUDCO, CBRI, RRL

Dr M.M. Dhar in his presidential lecture praised the efforts of CIMAP in developing agrotechnologies and processing technologies for economically useful medicinal and aromatic plants for all round development of perfumery, flavour, cosmetic and pharmaceutical industries in the country.

Welcoming the guests, Dr R.S. Thakur, Director, CIMAP, presented a brief account of R&D activities of CIMAP during the year 1990-91. He pointed out that under the 35-point Action Programme of the Government of India, in which CIMAP acted as a nodal organization for large scale cultivation and processing of medicinal and aromatic plants, a target of about 10% increase in cultivation had been achieved. CIMAP popularized and marketed its know-how among farmers, entrepreneurs and user industries and earned about Rs 0.3 million as fee. Also, the institute adopted a village, Jabri Khurd of Barabanki district, to develop it as 'Aushadhiya Gram' and intensified its extension activities so that fruits of research

reach the poor farmers. Narrating the achievements on research front, Dr Thakur disclosed that newly evolved high yielding strains of mints, palmarosa, and rose were in various stages of their pre-release testing. These varieties would increase the production per unit area. Dr Thakur further pointed out that a new water soluble derivative of antimalarial drug artemisinin, namely sodium- $\alpha$ -artelinate, was found to be quick in action and low in toxicity.

Dr Thakur also highlighted the research work done pertaining to agronomy, chemical engineering, tissue culture, plant protection and medo-botanical survey carried out during 1990-91. He expressed his thanks to the Director General, CSIR, Directors of sister laboratories, Chairman and members of Technical Advisory Board and Research Council, for their constructive support and guidance throughout the year.

Shri O.P. Virmani, Deputy Director, CIMAP, introduced Prof. Sharma to the audience and Dr D.V. Singh, Deputy Director, CIMAP, proposed a vote of thanks.



A low-cost house (financed by MOUD) at the exhibition on Alternative Low-cost Building Materials

and Building Centre-BASERA, was also arranged on this occasion at the RRL Building Centre, which was visited by students, architects, engineers, entrepreneurs, contractor concerned with housing project. □

### Centre for Plant Molecular Biology at NBRI

The Department of Biotechnology, Government of India, has sanctioned the establishment of a Centre for Plant Molecular Biology (CPMB) at the National Botanical Research Institute (NBRI), Lucknow, at a total cost of Rs 20.9 million. The Centre is aimed at carrying out research in the frontier areas of Plant Molecular Biology. This is the first Centre of its type to be established in the country and will broadly work on the molecular basis of cytoplasmic male sterility; chloroplast genome organization in *Populus*; insect pest resistance in crop plants through BT endotoxin and CPTI gene transfer and molecular organization of plant viral genomes and raising of trans-

genic lines with built-in viral resistance.

Dr P.V. Sane, Director, NBRI, is the principal coordinator and shall be overall incharge of the Centre. □

### Low-waste Chrome Tanning Salts

One of the most disconcerting wastes in effluents from streams in tanneries being the spent chromium tanning liquor, a scientific approach to the better management of chromium becomes necessary. The currently used chrome tanning salts and tanning methods lead to an uptake of only 50-55% of the 30,000 tonnes of tanning salts used in India annually. The constitution of spent chrome tanning solutions has now been analyzed at the Central Leather Research Institute (CLRI), Madras, and a new tetrapositive tetramer of chromium has been identified to be a chief contributor to the concentration of chromium in the waste tanning streams. Through designed alterations in the molasses reduction of Cr(VI)

and preparation of basic chromium sulphate salts, a new high exhaust, low waste chrome tanning salt has been developed, which exhibits an uptake behaviour of greater than 88%. This newly developed strategy for the preparation of basic chromium sulphate has received industrial sponsorship by a leading chrome tanning salt manufacturer in India. □

### Studies on fluidized bed reactors for fine powder systems

Shri N.K. Yadav, Scientist, Chemical Engineering Division of the National Chemical Laboratory (NCL), Pune, carried out experimental studies to determine the effect of fines on the hydrodynamic behaviour of a fluidized bed reactor using an industrial catalyst for acrylonitrile reaction. The make-up catalyst having fines (particles smaller than  $44\mu$ ) is continuously added to maintain a certain level of fines in the reactor. The fines have been reported to control selectivity in the fluid bed. The work carried out in an experimental size unit provided a scientific basis for need to maintain the critical fines concentration and also provides mathematical evaluation of the same for simple first order reactions.

Hydrodynamic studies with ammoxidation catalyst containing fines (0, 10, 20, 30, 40%) suggested that there exists a critical fines level at 30% which should be continuously monitored so as to operate the fluid bed in Geldart group AC regime. At 30% fines level, characteristic hydrodynamic features of higher bed voidage, lower cluster size and higher gas throughput in the dense phase were observed.

A general model for gas distribution in the fluidized bed has been proposed. The special feature of the model is that it treats the

dense phase as heterogeneous, comprising clusters and emulsion. The clustering phenomenon was studied with catalyst powder with varying fines content. The important feature of the model is that it can be extended to other Geldart groups such as Group B (by eliminating the cluster phase and possibly to group AC by eliminating emulsion phase).

Experimental data with an industrial catalyst containing fines (dp 44 microns) in the range of 0 to 50% were analyzed using the above model. The model could clearly show the existence of cluster and emulsion phases and their composition variations with fines and with operating gas velocities.

The effect of fines on selectivity and conversion was theoretically evaluated for simple first order reactions  $A \rightarrow \text{Product}$  and for  $A \rightarrow B \rightarrow C$ , with each step a first order reaction. The studies indicated that the effect of fines was to give higher conversion in cluster phase due to better contact and

higher contact time as compared to that in the emulsion phase. The transport of gas from cluster to emulsion phase was found to be controlled by the cluster size. The transport coefficients from cluster to emulsion decreased with the increase in the cluster size resulting in a higher conversion of intermediates to products for a fluid bed with higher fines content as compared with its critical value. This suggests the importance of critical fines level in optimizing selectivity of intermediates in reactions of the type  $A \rightarrow B \rightarrow C$  which could be controlled by adjusting the fines level, which in turn controls the cluster size. This justifies the need for maintaining a critical concentration of fines in the fluidized bed reactor of acrylonitrile at 30% fines.

Shri Yadav carried out these studies under the guidance of Dr L.K. Doraiswamy of NCL, Pune and Prof. M. Raja Rao of the Indian Institute of Technology (IIT), Bombay, and was awarded Ph.D. degree by IIT, Bombay. □

### **Field Demonstration on Large Scale Cultivation and Distillation of Aromatic Grasses-Palmarosa, Lemongrass and Citronella**

The Aromatic and Medicinal Plants Division of the Regional Research Laboratory (RRL), Bhubaneswar, organized a field demonstration on large scale cultivation and distillation of aromatic grasses - palmarosa, lemongrass and citronella, at the Palmarosa Farm of M/s Phulajhar Aromatics, Phulajhar, Rambha, Dist. Ganjam, Orissa, on 2 May 1991, under the Action Plan of CSIR. The demonstration programme was attended by over 30 participants including district officers from Revenue, Industry and Horticulture departments and voluntary organizations.

Shri Debi Prasad Jena, Additional District Magistrate, who inaugurated the programme,

commended the work of the Bhubaneswar laboratory in popularizing large scale cultivation of these new crops. He expressed his happiness over the utilization of marginal land at Phulajhar, which otherwise remained very much underutilized, for cultivating palmarosa and distilling oil with the technical consultancy of RRL-Bhubaneswar.

Welcoming the participants, Prof. H.S. Ray, Director, RRL, congratulated Shri U. Pradhan, Proprietor of the farm for his enterprise and thanked him for extending the facilities for the field demonstration.

This was followed by an introductory lecture on the crop by Dr

H.D. Saxena, Head, Aromatic and Medicinal Plants Division; remarks on transfer of technology by Shri J.R. Sahu, Head, Planning and Information Division; remarks by Shri Pradhan, and a vote of thanks by Dr S. Sahoo, Scientist, RRL-Bhubaneswar. Shri S.C. Paul, Shri P. Patra, Shri B.C. Mishra and Shri S.P. Kanungo, Scientists of the AM Division, took active part in the discussion and field demonstration that followed.

The primary aim of this programme was to demonstrate the agrotechnologies and distillation processes for these promising crops to the entrepreneurs, district officials and extension workers right in the growers' field, for promoting their large scale cultivation especially in the marginal and wastelands of the region. □

### **Chemical Examination of Some Indian Medicinal Plants**

Shri M. Marthanda Murthy while working at the Indian Institute of Chemical Technology (IICT), Hyderabad, carried out the chemical examination of some Indian medicinal plants. The main objective of the study was isolation and characterization of biologically active compounds from the higher plant extractives. The selection of plant species for investigation was based on their reported use in the traditional medicine and folklore remedies. A brief account of the studies made is presented here:

*Pygmacopremna herbacea* (Roxb.) Moldenke (Telugu: Gantubharangi) is an Ayurvedic drug used as a single drug or in mixed preparations for the treatment of a number of ailments. From the hexane extract of the crude drug, a novel diterpenoid quinone methide designated bharangin and a new phenalenone derivative designated pygmacone were isolated and their structures determined on the basis

of their mass, UV, IR, ID and 2D NMR,  $^{13}\text{C}$  NMR and CD spectral analysis. Bharangin exhibited remarkable cytotoxic properties on P-388 tumour system, anti-amoebic, antifungal, antibacterial and blood sugar lowering properties. With a view to studying structure activity relationships of bharangin, some of its reactions were investigated.

Extractives of *Azadirachta indica* seeds and kernels have been known to possess crop protective properties against insect pests. Fractionation of the ethanol extract of neem seeds resulted in the isolation of two analogues of azadirachtin designated as vepaol and isovepaol. Vepaol was found to be identical with 22,23-dihydro 23 $\beta$ -methoxy-azadirachtin and isovepaol, a new compound, was shown to be 22,23-dihydro-23 $\alpha$ -methoxyazadirachtin. The structures of these compounds were determined from a comparison of their  $^1\text{H}$  NMR data with that of azadirachtin. Vepaol exhibited remarkable insect antifeedant and growth regulatory properties against 1st and 3rd instar larvae of *Mythimina separata* (Oriental armyworm). A compound designated as nimbidin, also isolated along with vepaol and isovepaol, was found to be closely related to salannin from a consideration of its  $^1\text{H}$  NMR spectrum.

Neoisoshinanolone and 1-epineoisoshinanolone were isolated from the roots of *Plumbago zayanica*, an Ayurvedic drug.

Iguesterin, pristimerin and tingenone were isolated from the root bark of *Maytenus emarginata* which is reported to possess antitumour properties. The structure of iguesterin was determined from the analysis of mass, UV, IR,  $^1\text{H}$  NMR, CD spectra and by suitable chemical reactions.

Shri Marthanda Murthy worked under the guidance of Dr A.V.B. Sankaram of IICT, and Prof. Ch. Bheemasankara Rao, Andhra

University, Waltair, and was awarded Ph.D degree by Andhra University, Waltair, for his thesis based on these studies. □

## PROGRESS REPORTS

### CMRS Annual Report 1989-90

The Central Mining Research Station (CMRS), Dhanbad, during 1989-90 conducted investigations on 330 externally funded problems out of which 151 were new and 179 were continued from the previous year. Studies were completed on 101 problems and investigations were in progress in respect of 229 problems. Research was also carried out on 16 grant-in-aid projects which were taken up earlier. In addition to these, 24 problems of the nature of service to industry were taken up. Out of these, investigations were completed on 13 problems.

During the year, CMRS set up an all-time high record in earnings through its research and other technical services. The share of earnings from externally funded R

& D work zoomed to 103% of its non-plan expenditure from 83% during the previous year.

Technologies of seven items were transferred to 34 firms for large scale production. Six new patents were filed.

In the area of rock mechanics and mining methods, methods of extraction of coal seams were studied at Hatnal seam at Seetalpur colliery of ECL; at Bhelatand colliery of TISCO; for extraction of topmost lower Kajora seam and for final extraction of No.III seam underneath Bartunga hill at Chirimiri colliery of WCL.

CMRS pillar strength equation was used for studying the feasibility of extraction of Kenda seam below surface property in east sector at New Kenda colliery of ECL. A simple equation, based on a photoelastic modelling, was developed to calculate stress over ribs at any stage of depillaring panel. Factor of safety could be defined after knowing its strength at a particular stage. This study would help in mine planning for bord and pillar working either by caving or stowing.



A view of Chandman Copper open pit where CMRS carried out slope stability monitoring studies

Studies were made with an aim to make prediction and to achieve control of roof and ground movement parameters under specific geomining conditions to promote conservation and safety in coal mines. Ground movement investigations for affecting conservation of coal resources and development of methods of extraction of coal seams underneath surface features and structures were in progress over 97 panels/ workings in different coal fields.

CMRS developed an equation for determining maximum possible subsidence for Indian coal fields. A relationship was also established between volume of subsidence trough and other subsidence parameters which can be used to ascertain the volume of subsidence trough for reclamation purpose.

An evaluation of specific energy consumed by shearers for coal cutting was made for various operating longwall faces. A relationship was developed to predict field specific energy requirement for coal cutting as a function of laboratory specific energy, frequency of cleats of coal seam, depth of cover and thickness of extraction over a longwall face.

Based on the strata control observations at MLIV/2 panel in XVI seam of Moonidih coal mine of BCCL, it was concluded that the high stress conditions in the gate road require a yielding type steel prop which can yield upto 50 cm and should have a load bearing capacity of about 30 tonnes. For this, two designs of steel prop (one made of U-section steel and the other made of telescopic type steel pipes) were recommended. Investigation was made on the behaviour of strata and supports at W9 longwall panel at Dhemomain colliery and at W1 panel of Jhanjra project.

An estimation of necessary support capacity of roof rocks overlying Sanctoria seam at Parbelia

colliery was made by a method developed by CMRS.

Mechanized depillaring was experimented in eight coal mines by CMRS, covering 11 panels in different coalfields under varying roof conditions. This experimentation helped formulating support guidelines and prediction of roof fall in advance for mechanized depillaring panels using SDL and LHD.

Work was continued on methods of extraction and prediction and control of rock movement in non-coal mines. The stability of 43.4 m wide auxiliary shaft pillar and 48m thick crown pillar left at 7th level and stabilities of existing and proposed underground workings at Maldeota (Surkhet and Timli Blocks) and Durmala mines of PPCL were investigated.

In the area of rock mechanics and geomining techniques for opencast mines, investigations were made on ground stability.

Under the drilling and blasting research studies made at CMRS, 20 rounds of experimental blasts were fired at Haripur colliery of ECL and blast induced vibration was studied. An equation was developed to predict level of vibration and calculate safe charges. To minimize vibration it was recommended that the safe charges for different distances should be calculated from the suggested equation considering 5 mm/s as the safe limit of vibration. Blasting pattern was suggested to contain fly rock, improve fragmentation and reduce vibration.

Studies were continued for detection, prevention and combating mine fire. After receiving an SOS call from authorities of Jitpur colliery of IISCO, an investigation was undertaken to deal with a fire which erupted through stopping No 1 and 2 of sealed off BMT 1 panel. Thermal survey conducted by CMRS using infrared thermometer helped identify the vul-

nerable points. To deal with the fire, hydrogel of silicic acid was infused by a technique standardized by the CMRS. The dead space behind the gallery was filled with solid inert slurry. As the mine was gassy in nature, nitrogen was infused to lower down the oxygen percentage, contain the fire and maintain the environment below the explosive limit.

Following an incidence of fire in S4 panel of Jambad bottom seam, JK unit of Madhujore colliery of ECL was sealed off at pit top, causing production loss of about 300 tonnes of coal per day and rendering 800 workers idle. An all out effort was made jointly by CMRS and mine management to recover the mine. It was decided to flush liquid nitrogen through borehole for quick lowering of temperature and oxygen content of mine environment. This resulted in reopening of the mine in a record time of only three and a half month.

During the year, 30 papers were published and 51 were presented in conferences/symposia. □

## **TRAINING COURSES**

### **International Training Programme on Environmental Assessment and Monitoring**

An international workshop was organized at the Central Leather Research Institute (CLRI), Madras, during the meeting of Heads of States of Commonwealth held in October 1989 in Malaysia, where it was decided to launch a coordinated and joint global effort to meet the increasing environmental threats. This declaration came to be known as Langkawi declaration. Canada agreed to sponsor candidates from developing countries to undergo training in the area of environment under this declaration.



Recently, the Commonwealth Fund for Technical Cooperation, London, sponsored a course at CLRI (1 March-25 April 1991) in which trainees from 17 countries (St. Lucia, Jamaica, St. Kitts, Belize, Zimbabwe, Harare, Malawi, Papua New Guinea, Sierra Leonean, Guyana, Mauritius, Tanzania, Western Samoa, Ghana, Malta, Zambia and India) participated. The eight-week training programme concentrated on environment: environmental monitoring, environmental analysis and environmental legislations. The special features of the programme included field visits to industries and discussion with representatives of industries. A number of special lectures also formed part of the course; the distinguished speakers included Dr S. Varadarajan, Dr M.S. Swaminathan, and Prof. M.G.K. Menon. The course was inaugurated by the Chairman and Managing Director of Manali Refineries Ltd, Madras. The concluding session held on 24 April was presided over by Dr Sathikh. □

### Corrigenda

The photograph on the cover page of *CSIR News* 15 April 1991, is that of the solar water heating system at HAL, Bangalore and not at NAL, Bangalore, as mentioned. The system employs flat plate collectors with NAL black chrome.

The photograph related to Flexural test on slurry infiltrated fibre concrete specimen at SERC-Madras, appearing on the first page of *CSIR News* 15 May 1991, has been printed upside down.

The names of the patentees of the Patent No. 1022/DEL/90 published on page 72 of *CSIR News* 30 March have been wrongly printed. The correct names are: J.B. Pandya, B.D. Shethia, M.R. Rathod and E.R.R. Iyengar.

The above errors are very much regretted. □

## Honours & Awards

### Dr R. Haque

Dr R. Haque, Director, Central Fuel Research Institute (CFRI), Dhanbad, has been nominated a Member of the Task Force for Oil Shales in the North-Eastern India, set up by the Ministry of Petroleum and Chemicals, Government of India, under the Chairmanship of Shri B.K. Rao, Secretary (Mines).

The Ministry of Environment and Forest, Government of India, has constituted a Special Committee to go into the details of Green House Effect under the Chairmanship of Dr A.P. Mitra, FRS, former Director General, CSIR. CSIR has drawn up a programme on Global Change (environmentally speaking) and for this programme, Dr R. Haque, Director, CFRI has been nominated a Member to undertake specific studies on methane emission from paddy field, besides estimating the release of carbon dioxide into atmosphere by the burning of fossil fuels in this country. On behalf of the Director, CFRI, Dr Gulab Singh of the institute was deputed to attend a meeting of this Committee, held in Delhi recently in which the CFRI report on production of CO<sub>2</sub> from coal utilization was submitted to the Chairman. □

### PATENTS FILED

1276/DEL/90: A process for the synthesis of 4, 5-substituted 2-oxo-4-oxazolidine carboxylic acids, D.K. Dikshit, S. Singh, G.K. Patnaik, R.C. Srimal and B.N. Dhawan — Central Drug Research Institute, Lucknow.

1278/DEL/90: An improved process for the autocatalytic (electroless) deposition of nickel on metallic surfaces from acidic baths, K. Narang, T.L. Sharma, I. Singh — National Metallurgical Laboratory, Jamshedpur. □

1280/DEL/90: A novel flux for the production of superior quality zinc base alloys, C.S. Sivaramakrishnan, R.K. Mahanti and K. Lal — National Metallurgical Laboratory, Jamshedpur.

1281/DEL/90: An improved process for iron electroforming using cast iron as an anode, K. Narang, I. Singh and M.N. Singh — National Metallurgical Laboratory, Jamshedpur.

## ANNOUNCEMENTS

### Harl Om Ashram Prerit Shri S.S. Bhatnagar Research Award for Desalination

The Director, Central Salt & Marine Chemicals Research Institute (CSMCRI), Bhavnagar, invites applications/nominations from person(s) who have carried out original research work in the field of Desalination, for consideration for the above referred award for 1990. The award is of Rs 8000 to be divided into two cash prizes of Rs 5000 (1st prize) and Rs 3000 (IInd prize).

The award is open to an Indian citizen/team for his/her/their outstanding original research work carried out during five years immediately preceding the year of grant of award, i.e. the work done during the period 1985-1989 will only be considered.

The application in the prescribed proforma along with relevant documentary evidence (in six copies each) may please be submitted to the Director, CSMCRI, Gijubhai Badheka Marg, Bhavnagar 364002 (Gujarat) before 31 August 1991 for consideration of the expert committee.

The rules and regulations governing the award and the prescribed application form can be had from the Scientist, Planning Cell, CSMCRI, by sending a self addressed stamped envelope (size 26.5 x 11 cm). □

## Industry-oriented Technology Courses at CECRI

The Central Electrochemical Research Institute (CECRI), Karaikudi, will be conducting the following Industry-oriented Technology Courses in 1991:

**A. Electrochemical Materials Science, Electrodeics, Pollution Control; Electrochemical Electronics and Instrumentation and Library Automation**

(i) Basics of Electrochemistry (8-12 July)  
Coordinator — Dr P. Radhakrishnamurthy  
Course Charges — Rs 750

(ii) Electrochemical pollution control and monitoring with special reference to electrochemical industries (15-20 July).  
Coordinator — Dr R. Vijayavalli  
Course charges — Rs 750

(iii) Microprocessors and their applications (22-27 July)  
Coordinator — Shri C. Srividyaarajagopalau  
Course Charges — Rs 750

(iv) Computer concepts for library applications (7-11 October)  
Coordinator — Shri N. Meyyappan  
Course Charges — Rs 750

(v) Programming in dBase III plus for library applications  
Coordinator — Shri R. Srinivasan  
Course charges — Rs 750

**B. Inorganic/Organic Electrochemicals and Electrometallurgy and Thermics**

(i) Water treatment technology (5-9 August)  
Coordinator — Dr K.C. Narasimham/Shri V. Rengarajan  
Course charges — Rs 750

(ii) Caustic soda and chlorine technology (12-17 August)  
Coordinator — Shri S. Krishnamurthy

Course charges — Rs 750

(iii) Technology of inorganic electrochemicals (19-23 August)  
Coordinator — Shri V. Rengarajan  
Course charges — Rs 750

(iv) Technology of organic electrochemicals (26-30 August)  
Coordinator — Dr P.N. Anantharaman  
Course charges — Rs 750

(v) Electrometallurgy of aluminium and magnesium (2-6 September)  
Coordinator — Shri T. Selvin Devasahayam  
Course charges — Rs 750

**C. Corrosion Science and Engineering**

(i) Corrosion science and engineering (general) (5-10 August)  
Coordinator — Shri Y.V.P. Ramachandra Row  
Course charges — Rs 1000

(ii) Cathodic protection systems and devices and anodic protection (12 - 17 August)

Coordinator — Shri N. Palaniswamy  
Course charges — Rs 1000

(iii) Inhibitors for corrosion prevention (19-24 August)  
Coordinator — Dr G. Venkatachari  
Course charges — Rs 1000

(iv) Corrosion of steel in concrete (26-31 August)  
Coordinator — Dr N.S. Rengaswamy  
Course charges — Rs 1000

(v) Corrosion control in oil and gas production and in refineries (2-7 September)  
Coordinator — Shri P. Subramanian  
Course charges — Rs 1000

(vi) Corrosion control in fertilizer industry (9-14 September)  
Coordinator — Shri T.M. Balasubramanian  
Course charges — Rs 1000

(vii) Corrosion control in sugar industry (16-21 September)  
Coordinator—Smt. C. Marikkannu  
Course charges — Rs 1000

(viii) Pipeline corrosion and its control (23-28 September)  
Coordinator — Shri R. Meenakshisundaram  
Course charges — Rs 1000

(ix) Corrosion control in steel industries (30 September-5 October)  
Coordinator — Shri S. Ramu  
Course charges — Rs 1000

The minimum qualifications for each course are: Bachelor's degree in Chemistry, Physics, Metallurgy or Engineering or Polytechnic Diploma. Relaxable in special cases of candidates who are otherwise suitable as entrepreneurs and candidates sponsored by employers.

For further details, write to: Director, CECRI, Karaikudi 623006, Tamilnadu. □

## CSIR Senior Research Fellowships and Research Associateships

CSIR has invited applications for awarding Senior Research Fellowships and Research Associateships vide an advertisement [No.SRF/RA-EMR.1/91(2nd)] appearing in the 6 July 1991 issue of *Employment News*. Eligibility conditions and application proforma are published alongwith the advertisement. The application form may be cut out or copied from advertisement and used. Indians presently abroad can also apply.

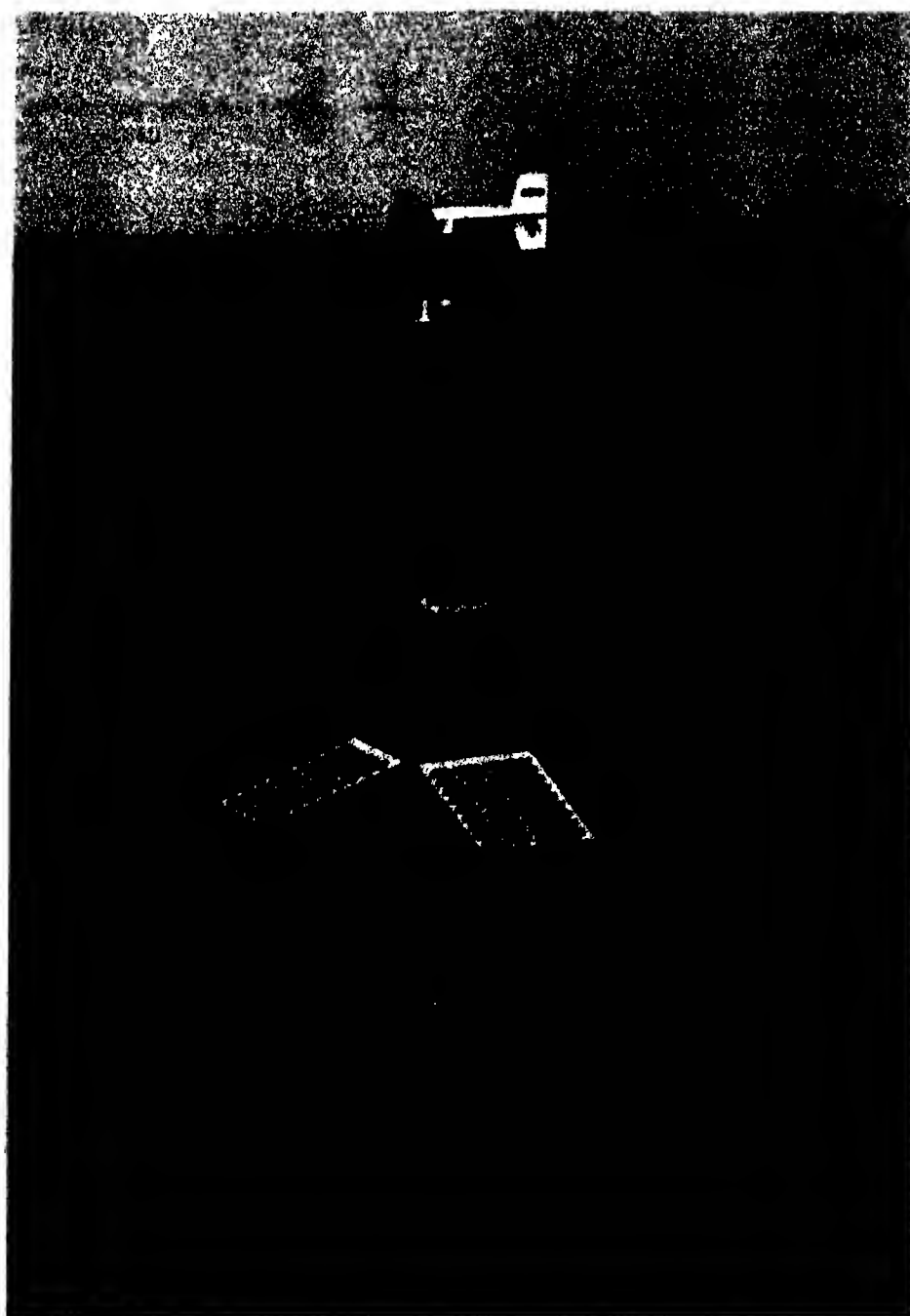
The last date of receiving applications is 16 August 1991. The applications duly completed in all respects should be sent to the Under Secretary, Extramural Research Division, Human Resource Development Group, CSIR Complex, Dr K S Krishnan Marg, NPL Campus, Pusa, New Delhi 110012.

# CSIR NEWS



A SEMI-MONTHLY  
HOUSE BULLETIN OF CSIR

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## IN THIS ISSUE

NRDC Independence Day (1991) Awards for Meritorious Inven- tions	183
Science Cooperation between CSIR of India and SBTS and NSFC of China	188
India-Bangladesh S&T Co-operation	189
Thermal Stabilization of Rice Bran	189
Speciality Paper Plant at Karukutty starts production using RRL- Jorhat Technology	190
Harsha—The portable high efficien- cy multifuel chulha	190
Theoretical Studies of Molecular Reaction Dynamics – Dr N.Sathyamurthy's Bhat- nagar Prizewinning work	191
Special issue of Indian Journal of Radio & Space Physics on Thir- ty Years of Scientific Ballooning in India	192
Prof. B.B.Dhar appointed Director of CMRS	193

The National Institute of Oceanography, Goa, completed the design and basic electronics of a moored data buoy (shown in photograph) during 1990-91.

A report on the significant R&D activities of the Institute for the period appears on p. 182.

## R&D Highlights : 1990-91

The National Institute of Oceanography (NIO), Goa, during 1990-91, gave major thrust to: (A) National S&T Programmes which included Oceanography of the Exclusive Economic Zone (EEZ), Survey for Polymetallic Nodules, Antarctic Oceanography, Air-Sea Interaction, and (B) Bilateral Programmes, namely, (1) Indo-German Programme on Particle Flux Studies in the Bay of Bengal; (2) Indo-US Programme on Bioactive Substances from the Indian Ocean and Accelerated Corrosion of Metals and Alloys in the Marine Environment and (3) Indo-USSR Programme on the Trans-Indian Ocean Geo-traverse Studies and Air-Sea Interaction in relation to monsoon dynamics. Another important international programme undertaken by the Institute was the exploration of Caribbean waters, on board research vessel *Sagar Kanya*, for the benefit of the Caribbean countries, which was hailed as a new initiative in the south-south cooperation.

The Institute undertook 22 new contract research projects during the year with a contract value of Rs 38 million. The cash flow during the year from external sources was Rs 72 million.

### International Geosphere-Biosphere Programme (IGBP)

Distribution of the green house gases, carbon dioxide and nitrous oxide was studied in detail in the Arabian Sea.

Study on inorganic carbon components in the Arabian Sea indicated that Titration Alkalinity (TA) decreases from north to south and also from west to east.  $\text{TCO}_2$  also behaved similar to TA but with a very clear decreasing trend southward at all depth levels.  $\text{TCO}_2$  was

found to be around  $2400 \mu\text{mol dm}^{-3}$  at equator but in north it was more than  $2600 \mu\text{mol dm}^{-3}$ , with a maximum of  $2650 \mu\text{mol dm}^{-3}$  in the deeper layers. The most significant phenomenon was the deepening of isopleths ( $2300 \mu\text{mol dm}^{-3}$ ) around  $12^\circ\text{N}$ . This could be due to the influx of the Red Sea water and its influence could be felt even in very deep layers.

Measurements of nitrous oxide ( $\text{N}_2\text{O}$ ) at 16 stations in the Arabian Sea revealed high degree of surface saturation ( $186 \pm 37\%$ ) and consequently large atmospheric fluxes of  $\text{N}_2\text{O}$  ( $4.46 \pm 2.60 \mu\text{mol m}^{-2}\text{d}^{-1}$ ). Usually high for a non-upwelling period, these values reflect the large vertical gradients of  $\text{N}_2\text{O}$  just below the mixed layer as the vertical exchange coefficients ( $0.55 \pm 32 \text{cm}^2 \text{s}^{-1}$ ) required to sustain the observed fluxes are not very high. The mechanisms proposed so far for the production of  $\text{N}_2\text{O}$  were re-evaluated in the light of recent data on the nitrogen

isotopic composition of  $\text{N}_2\text{O}$  from the western North Pacific Ocean. A nitrification-denitrification couple represented by the pathway  $\text{NH}_4\text{-NO-N}_2\text{O}$  was proposed to be potentially dominant mechanism for  $\text{N}_2\text{O}$  production in the ocean. This can explain the observed enrichment of  $^{15}\text{N}$  in  $\text{N}_2\text{O}$  as compared to  $\text{NO}_3$  while nitrification or denitrification alone cannot do so.

Appreciable horizontal (east-west) gradients in  $\text{N}_2\text{O}$  concentrations were observed at intermediate depths close to the continental margin off the west coast of India suggesting a possible sink of  $\text{N}_2\text{O}$  within the marginal sediments. The diffusive losses of  $\text{N}_2\text{O}$  to the denitrifying waters and marginal sediments were estimated as  $2 \text{Tg Ny}^{-1}$ . The Arabian Sea as a whole appeared to be a net source of  $\text{N}_2\text{O}$ . The result suggested that the oceanic  $\text{N}_2\text{O}$  production could have been underestimated so far. The emission of



1. 3-D picture of the sea floor in an area of the Central Indian Ocean

N<sub>2</sub>O from the ocean to the atmosphere was proposed to be at least 10 Tg N annually.

#### **Polymetallic Nodules**

Detailed and accurate bathymetric maps of the Central Indian Ocean Basin (CIOB) area of about 145,000 sq. km were prepared. These maps are of immense importance as the topographic variations on the seafloor are found to influence chemical composition of nodules as well as the variability of nodule occurrence (Photograph 1).

A number of new seamounts, swells, small ridges, valleys and fracture zones were mapped in the CIOB area. During extensive bathymetric survey in the basin, a number of seamounts were encountered. Various physical and morphological parameters of these seamounts were measured. The seamounts occurring on Cretaceous oceanic crust were found to be taller, wider and flatter than those occurring on lower to mid Tertiary oceanic crust. Distribution and abundance of these volcanic seamounts of hotspot origin manifest the movement of Indian Plate in geological past. Taller and wider seamounts appear to experience continuous growth as a result of tapping of the magma chamber that moves with them while smaller seamounts from the younger oceanic crusts are considered to be the result of stress depleted magma conduit. Non-uniform spacing of these seamounts could be related to variable speed of gliding of the Indian Plate over hotspot in geological past.

Radiochemical and paleontological studies revealed that erosion of top sediments in nodule bearing areas is due to circulation of cold water.

A system for cataloguing and interpretation of seabed photographic data was evolved and used

## **NRDC INDEPENDENCE DAY (1991) AWARDS FOR MERITORIOUS INVENTIONS**

Two CSIR processes have won the 1991 Independence Day Awards of the National Research Development Corporation (NRDC) under its Invention Promotion Programme. The processes are:

#### **Microprocessor-based Automatic pH Control System for Sugar Industry**

Shri Laxmi Narayan, Dr G.N. Acharya, Shri K.S.N. Rao, and Shri Kota Srinivas of the Central Electronics Engineering Research Institute (CEERI), Pilani, have been jointly awarded a sum of Rs 30,000 for the development of microprocessor-based automatic pH control system for optimizing the juice clarification process in sugar industry. The device controls continuously the flow of lime and sulphur dioxide gas and thus controls the pH of the treated juice at the optimum level in the sulphiter stage. Over 100 systems based on

this technology have been installed in various sugar factories in the country.

#### **Process for the Manufacture of Low-Moisture Refractory Composition**

Dr Anukul Chandra Das and Dr Goutam Banerjee of the Central Glass & Ceramic Research Institute, Calcutta, have been jointly awarded a sum of Rs 25,000 for the development of process for the manufacture of low-moisture refractory composition containing 45-50% alumina useful for the preparation of high performance refractory castables. The invention pertains to the development of a castable aluminous refractory composition using low-cost and readily available raw materials such as wide variety of aluminous grog, sillimanite sand, microfine silica waste, etc. together with calcium aluminate binder and defloculant. The product is presently being used in the steel plants.

to predict the potential impact of nodule mining in the CIOB-area.

An unusual spin off from the study of nodule was the recovery of flanged tektite (australite) button from the surficial sediments in CIOB area at a depth of 5300 m which signifies a large westward extension of the australite sub-stream field into the Indian Ocean. Occurrence of this tektite in CIOB area casts doubt on long held views that australite do not occur north of 23°S Lat.

#### **Antarctic Oceanography**

One scientist from the institute

participated in the tenth Antarctic Expedition. The studies carried out in the Antarctic region show that the horizontal kinetic energy near the ice shelf of Dronning Maud Land coast of Antarctica during austral summer season is chiefly controlled by tides and the surface wind forcing is inhibited by shallow seasonal thermocline. Tectonic map of astrid ridge of Queen Maud Land was prepared.

The physico-chemical and biological studies in Antarctic Lakes at Schirmacher indicated the lake waters to be super-saturated with oxygen. The in-

crease in chlorophyll and benthic microfauna over the years suggested the influence of human interference. The microbenthic faunal distribution was found to vary from lake to lake depending on the sediment texture.

#### Island Development Programme

Site suitability studies were carried out in the coastal waters of Andaman for setting up of demonstration aquaculture production system; 8 suitable areas were identified. Transfer of technology of intense polyculture of finfishes was successfully demonstrated in Andaman and Nicobar group of islands.

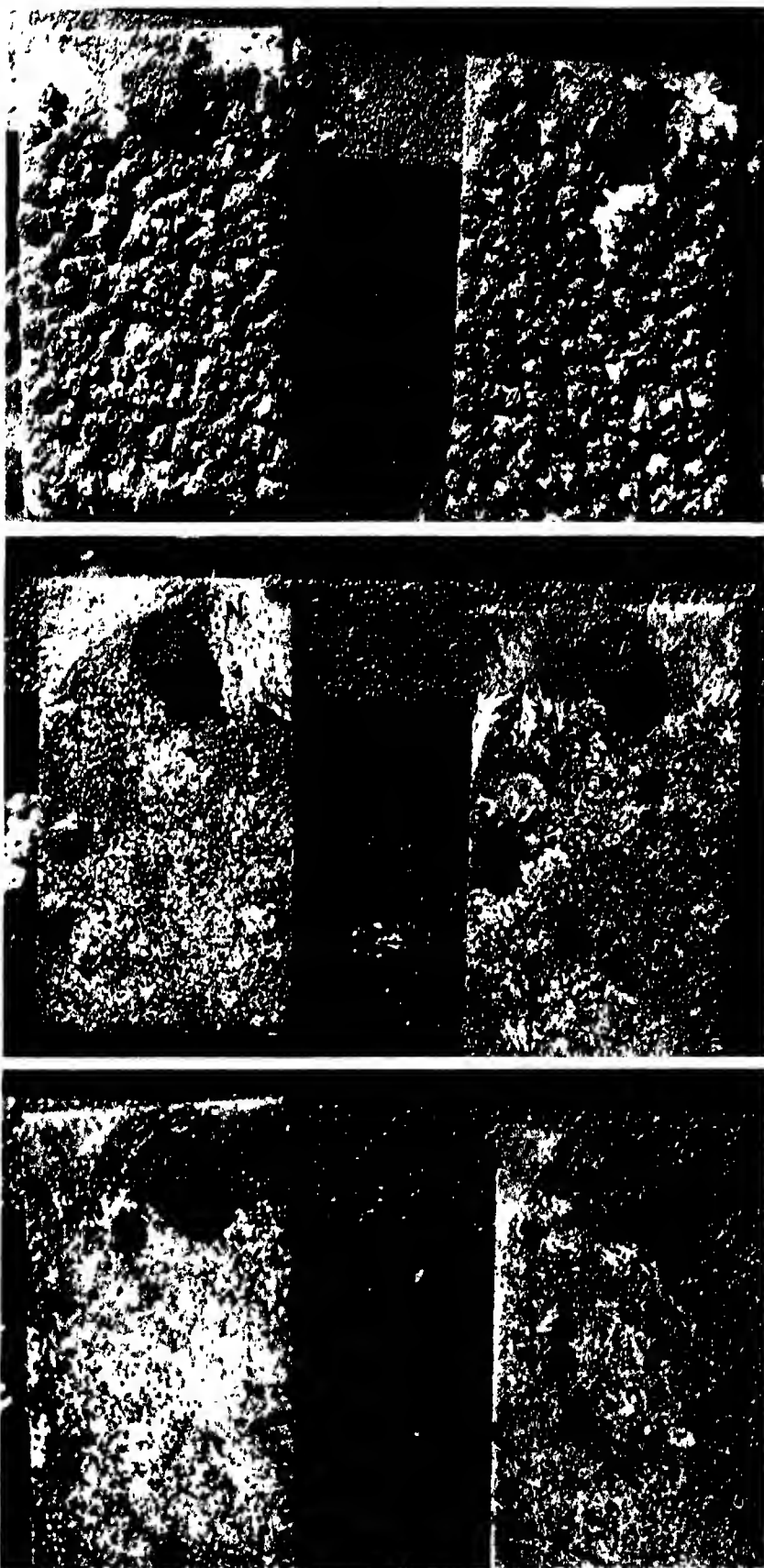
Mapping of mangrove distribution of Andaman and Nicobar Islands was completed. Total mangrove area has been estimated to be about 80,000 ha.

#### Coastal Zone Management

Mangrove vegetation of Kerala, Karnataka, Goa, Maharashtra and Gujarat was surveyed by using land-sat data, aerial photographs and ground-truth data.

Studies on the beach and surf zone dynamics between Ratnagiri and Mangalore on the west coast of India suggested that the beaches are stable over the annual cycle. The annual net sediment transport direction varies along the study area, being southerly at Ratnagiri, Tadri and Mangalore and northerly along Vengurla. The sediment transport is relatively low at Vengurla, Mangalore and Coondapur throughout the year.

The inlet hydrodynamic studies at the mouth of the Chilka Lake in Orissa, which constantly migrates towards north, showed that the reduced cross-section of the inlet mouth affects the tidal prism and the ecology of the lake. The studies suggested that an artificial opening 700m wide and 10m near Brahmapur could be



2 Marine growth on experimental panels painted with (a) Paint, (b) Paint + fruit extract of *Sapindus trifoliatus* and (c) Paint + fruit extract of *Randia brandisii*, after two month's exposure in marine environment



more effective to increase the tidal prism.

Coastal oceanographic studies were undertaken at a few locations along the coast for management of coolant water intake and discharge for nuclear power plants. Crucial environmental factors such as probable stagnation of warm water and abrupt water temperature variations associated with frontal movement were delineated at these

locations. Thermal pollution regulatory limits for shore based nuclear power plants in relation to environmental and biotic conservation measures were delineated.

#### Air-sea Interaction

A high coherence was found between the sea level pressure and sea surface temperature during the formation of monsoon low pressure systems over the head of Bay of Bengal.

The heat budget investigations of the Caribbean Sea indicated a surface heat gain of about  $50 \text{ Wm}^{-2}$  during pre-hurricane period.

The specific humidity gradient was found to be the controlling factor for higher premonsoonal evaporative heat flux over the southwestern Arabian Sea.

The premonsoonal SSTs of the Arabian Sea were found to be positively correlated with the monsoon rainfall while the relation was negative during post-monsoon.

The convective activity in the atmosphere overlying the western Arabian Sea was moderately suppressed during summer monsoon of 1983.

The spectral analysis of surface meteorological parameters of the Arabian Sea collected over a period of 25 years (1948-72) indicated energy peak at 2-4 year period.

The surface area of the warm pool (region  $> 28^\circ\text{C}$ ) in the equatorial Indian Ocean was found to decrease from  $24 \times 10^6 \text{ km}^2$  in April to  $8 \times 10^6 \text{ km}^2$  in September.

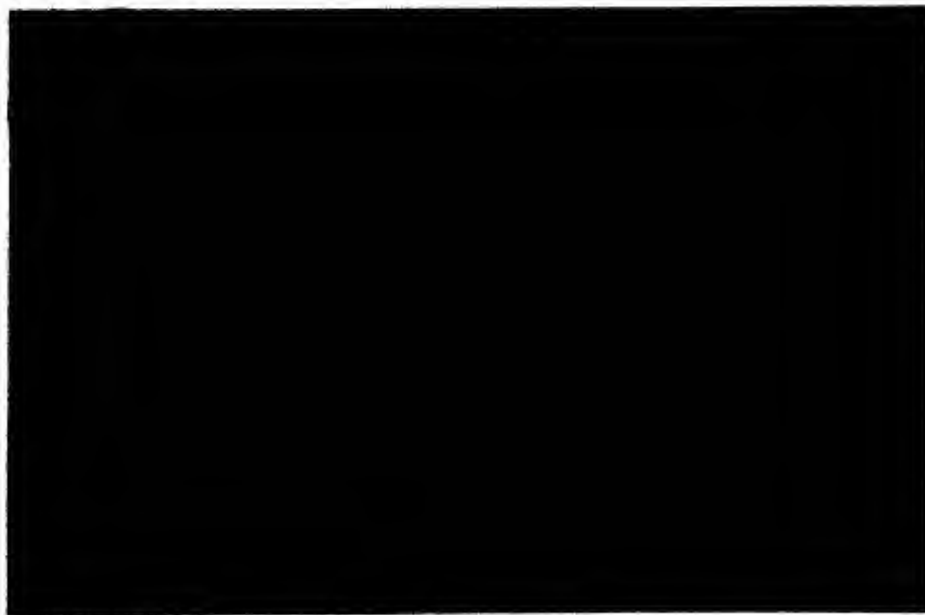
Resources and Parameters Mapping of the EEZ of India

*Physical processes:* The studies revealed that the surface wind drift along the west coast of India during monsoon period weakens as the poleward undercurrent strengthens and vice-versa. The upwelling band of 40 km wide along the western boundary of the Bay of Bengal during summer monsoon is of typically wind driven nature and an undercurrent is suggested below the upwelling band. The dynamic topography outside the upwelling band has cellular structures possibly indicating the presence of shelf waves with longshore wavelength of 400-500 km.

The cyclonic gyre occurring during monsoon period in the southern Bay of Bengal is primarily due to positive wind stress curl and the boundary anticyclonic cells are



3. Accumulation of cysts of *Artemia* at the edges of pond



4. Adult *Artemia* (size 10mm) – an important live feed for shrimps and fish hatcheries

influenced by fresh-water influx. The mass balance studies suggested an upward velocity of about  $2 \times 10^{-6} \text{ ms}^{-1}$  from the depth of 2500 m in the central Bay of Bengal. The signature of coastal upwelling showed latitudinal variation during summer monsoon along the western boundary of the Bay of Bengal.

The presence of equatorial undercurrent was inferred in the western Indian Ocean, based on the data of XBT crossings which are made during southwest monsoon. However, a full-fledged equatorial surface jet was found between  $84^\circ\text{E}$  and  $92^\circ\text{E}$  in association with strong undercurrent beneath it during the premonsoon time.

The studies on tides in the deep Arabian Sea indicated the stronger nature of  $M_2$  tidal current over  $S_2$  and  $K_1$  currents.

**Modelling:** An analytical model linking the geometry of the cross-section and the estuarine dynamics was developed. The model shows that the diffusion coefficient over a tidal cycle in rectangular channels can lead to flood dominance and channels with mud flats can lead to ebb-dominance.

A numerical model using semi-implicit scheme to simulate tidal circulation along the west coast of India was validated; the model simulates phases accurately rather than the amplitudes. The results indicated the effect of geometry in causing high tidal amplitudes in the Gulf of Kutch.

**Remote sensing:** Studies using remotely sensed data on ocean colour, showed that the growth response of phytoplankton leads to biological implications with inter-annual variability affecting the evolution of sea surface temperature and thereby the climate.

**Chemical processes:** Geographical extent of denitrification in the Arabian Sea was estimated in

relation to the physical processes. Nitrite distribution showed little correspondence with primary productivity and the three major sites of seasonal upwelling appeared to be located outside the zone of intense denitrification. The locus of the most intense denitrification appeared to extend southwest from the shelf break off Gujarat.

The riverine inputs of materials into the Arabian Sea and the Bay of Bengal were calculated. The major ion contents were found to be inversely proportional to the river runoff specifically for the rivers joining the Arabian Sea. The Bay of Bengal receives total dissolved solids of the order of  $207 \times 10^{12} \text{ gy}^{-1}$ . On an average the Indian rivers are enriched in major ions as compared to the average for world rivers.

**Pollution:** Maps on pesticide residues in the surficial sediments along the west and east coasts of India were updated.

The sea surface microlayer (SML) and sub surface layer (SSL) studies in the northern Arabian Sea indicated enrichment of nutrients in SML compared to those in SSL, and a decrease in enrichment factor towards offshore.

The static bioassay tests of oil dispersants such as castrol and slickgone LTE on green mussel and prawns indicated that castrol is preferable to slickgone LTE for application to the Indian marine environment.

Water quality study in Bombay High indicated decrease in dissolved oxygen (DO) but no other change in water quality parameters over the years from 1976 to 1988.

Coastal pollution monitoring study around Bombay indicated that the prevailing pollution has not reached the alarming stage to cause high instantaneous mortality.

Comparative study of chaetognaths fauna inhabiting nearshore waters of Bombay indicated that the chaetognath population steadily declines and *Sagitta bedoti* is the only tolerant species in sewage polluted area.

Coastal pollution monitoring study between Cochin and Mangalore indicated that the observed values of various parameters are within acceptable water quality levels. Investigations along the north-west coast of India between Okha and Ratnagiri showed the values for the regions free from contamination to be comparable within the general variability inherent to the nearshore waters. However, the areas influenced by waste water release were typically characterized by low and fluctuating dissolved oxygen and higher  $\text{PO}_4^{3-}$ .

**Marine Biotechnology:** Antibodies of 3 strains of sulphate reducing bacteria and a species of marine fungus were raised in the laboratory. These have wide applications in the environmental protection, biomedical and improvisation of food resources.

High cellulose content of 31% was recorded in a marine algae *Valoniopsis pachynema* and its use for paper pulp manufacture was investigated.

Method for extraction, testing and stabilization of LAL — a universal endotoxin tester from Horseshoe Crab — was standardized for commercialization.

**Geological studies:** Geochemical studies on surficial sediments of the western continental margins of India indicated high concentration of Mn in the lower slope and deep sea region. This high concentration was attributed to the supply of Mn released from the upper slope sediments under the anoxic conditions. In the sediments of the upper slope region, organic carbon and  $\text{CaCO}_3$  contents were found to be high. This

feature was attributed to high production of overlying waters and preservation of organic carbon due to impingement of oxygen minimum layer on the slope.

Total magnetic intensity anomaly maps of the western and eastern shelves of India and their associated structural trends were delineated. A system of NNE-SSE trending faults greatly influenced the basaltic and granitic basement off Bombay High. The lateral extent of two major regional faults between 18°48'N and 19°35'N latitudes were found to separate three crustal blocks consisting of the inner-shelf, the offshore basin and the Bombay High, indicating the rifting phase of the crust.

Multi-sensor underway geophysical data collected off Vengurla indicated the presence of buried creeks of fluvial origin, and these appeared to be the former positions of rivers flowing from nearby coast and debouching into the Arabian Sea during late Pleistocene.

A new NNE-SSW trending basement high/ridge, offset by E-W trending faults was identified in between 85°- 90°E ridges, in the Bay of Bengal.

Three contour maps were generated from the processed magnetic and bathymetry data of the eastern continental shelf and part of Bengal Fan (10 - 12°N, 80- 88°E). A major lineation in the central Bengal Fan suggesting the extension of 85°E Ridge to the northern part of the eastern continental shelf off Chilka Lake was delineated. It was observed that high magnetic anomalies occur over the northern part of the eastern continental shelf between Visakhapatnam and Chilka Lake suggesting a shallow basement.

**Ocean engineering:** Two computer-aided models, one to evaluate static and dynamic response of instrumental mooring in the deep

and shallow waters and the other for evaluating the stress for marine risers subjected to wave and current loadings, were developed.

The directional spectra of waves observed off Karwar on the west coast indicated that predominantly the high wave energy is concentrated between 235° and 248° during southwest monsoon and 215° and 220° during non- monsoon period.

A computer model was developed for obtaining two dimensional energy spectra using non-directional wave data.

A mesh-type surf zone suspended sediment trap was designed, fabricated and tested in the field. Also a gravity corer was designed and fabricated to obtain sediment core samples from the nearshore region for the purpose of geotechnical investigation.

### Corrosion

Study on macrofouling in Mormugao Harbour waters revealed higher fouling potential of aluminum panels as compared to that of fiberglass.

Field tests on antifouling using extracts of fruits of terrestrial plants *Randia brandisii* and *Sapindus trifoliatu*s revealed their settlement inhibition properties (Photograph 2 a,b,c).

Corrosion studies on five different construction materials indicated that the metals and alloys corroded in their decreasing order as mild steel > copper > cupronickel > brass > stainless steel.

At 1000 m depth, conjoint use of coating (paint) and sacrificial anode was found to be the most effective method for protecting mild steel.

Study on the effect of stresses on the permeability of salts in the concrete indicated that higher the stress level, more the penetration of the salts like chlorides and sulphates.

### Drugs and Diagnostics

Six new species of sponges and 11 new species of soft corals were discovered and described.

Active principles from *Acanthus illicifolius* (2- benzoxazolinone) and *Acanthophora spicifera* (aurantiamides) were synthesized and were under testing.

Chemical investigation of *Ircinia ramosa* resulted in the isolation and characterization of 5 minor sterols.

Several antibacterial compounds were isolated from the sponge *Haliclona* sp.

### Marine Instrumentation

A first model of recording electronic bathythermograph was released to NRDC for commercialization.

The design and basic electronics of a Moored Data Buoy was completed. The entire buoy system was tested as per specifications.

### Acoustic Tomography

NIO participated in the international programme 'Heard Island Experiment' onboard ORV *Sagar Kanya* during January-February 1991 and collected data on acoustic field utilizing deep sea drifting buoys, sono buoys and receiver arrays suspended from the ship.

Ray tracing employing range-dependent programme was carried out utilizing 66 historical sound speed profiles starting from the Heard Island (53°13.9', 74°30.6'E to 10°N and 74°E) covering a propagation range of 7000 km. It was found that for source depth of 150 m, the travel time was of the order of 4686 seconds and the intensity loss was 150 dB.

Studies on optimisation of acoustic source and receiver depths in the ocean revealed that maximum number of eigen rays reach the receiver when the transmitter and receiver are both located close to the sound speed minimum

layer. Identification of the acoustic rays is simplified employing the beam forming techniques.

#### Indo USSR Programme on Oceanography

Diagnostic and semi-diagnostic modelling of the Arabian Sea circulation during summer and winter monsoon seasons resolve the fields of temperature, salinity and currents fairly well, comparable with the climatic data. The same model when extended to equatorial regions of the Indian Ocean could simulate the complete system of equatorial currents.

MIR submersible investigations in the Back Arc basins of the southwest Pacific showed the presence of active hydrothermal zones with massive sulphide deposits. These deposits mainly contain copper and zinc with significant concentrations of lead, arsenic, bismuth, silver, gold, etc. Such type of deposits can be expected in the Back Arc basin of Andaman Island.

Thickness of the Paleozoic, Mesozoic and Cenozoic formations and the oldest Mesozoic oceanic crust and the abandoned ridge axis were identified between 11° and 18°S lat. from northwest continental margin of Australia to the Mascarene Plateau. Continental crust of the Exmouth plateau and Joey Rise is overlain by Paleozoic, Jurassic, Middle Cretaceous (3.6 km thick) and Cenozoic (2 km thick) sediments. The Mascarene plateau consists of relict continental crust and is overlain by the Mesozoic - early Paleocene volcanics of 2-4 km thick sediments.

The processed seismic sections of the deformation zone in the central Indian Ocean indicate the area south of the equator to be more deformed compared to that in north. Both the basement and the overlying sediments are deformed into a series of anticlinal folds having both long (150 km) and

short (20 km) wave lengths. The vertical uplift of the folded basement/sediments is nearly 375 m in the area of maximum deformation. The deformed sediments are bounded by high angle reverse faults.

#### Indo German Project on Particle Flux Studies

Twelve sediment traps were recovered and redeployed in the northern Indian Ocean at 6 sites during the cruise of RV *Sonne*. Particle fluxes measured continuously for one year at three locations in the Arabian Sea using time-series sediment traps showed that lithogenic sedimentation processes are strongly coupled to biological processes. The vertical flux of lithogenic matter is controlled by episodic production and fluxes of biogenic matter.

#### Caribbean Oceanographic Resources Exploration (CORE) Project

The institute undertook exploration of Caribbean waters onboard the research vessel *Sagar Kanya* during April-May 1990 for the benefit of Caribbean countries under the Caribbean Oceanographic Resources Exploration Project (CORE). The CORE Programme was developed by the Commonwealth Science Council (CSC) in collaboration with

Department of Ocean Development, NIO and the Caribbean Commonwealth. This was hailed as a new initiative in the South-South Cooperation and biggest project ever initiated by CSC for promoting scientific collaboration among Commonwealth countries.

#### Data Products

Geophysical atlas of the eastern Arabian Sea was brought out showing bathymetric, magnetic and gravity data in the form of two and three dimensional diagrams.

#### Oceanographic Surveys

Seven cruises on ORV *Sagar Kanya* and 1 cruise on MV *Nand Rachit* were undertaken. About 3700 mandays were spent on board the vessels for collection of oceanographic data and information from Arabian Sea and Bay of Bengal.

#### Technology Transfer

The commercial scale technology for culture of brine shrimp *Artemia* was transferred to M/s Ballarpur Industries Ltd. The culture of *Artemia* was introduced in the salt pans in Singach near Jamnagar, Gujarat. About 400 kg of dry cysts of *Artemia* were harvested and commercialized (Photographs 3,4).

The institute celebrated its silver jubilee during the year. □

### Science Cooperation between CSIR of India and SBTS and NSFC of China

At the invitation of Director General, State Bureau of Technical Supervision (SBTS) and Executive Vice Chairman, National Natural Science Foundation (NSFC) of China, a CSIR delegation comprising Dr G. Thyagarajan, Director, Central Leather Research Institute, Madras, as leader and Dr S.K. Basu, Director, Institute of Microbial Technology, Chandigarh and Shri K.N. Johry, Adviser, Inter-

national Scientific Collaboration, as members visited Peoples' Republic of China from 24 June to 1 July 1991.

There has been a continuing dialogue between CSIR, NPL and BIS from Indian side and SBTS from Chinese side on need to establish cooperation in Metrology, Standards and Quality Control between the two countries. It was recently decided that CSIR and

SBTS may enter into a formal protocol of cooperation. During the visit of CSIR delegation, a protocol on Cooperation between CSIR and SBTS was signed by Shri K.N. Johry on behalf of CSIR and Dr Lu Shaozeng, Deputy Director General, on behalf of SBTS. The areas of cooperation include: Physico-Mechanical Standards, Electrical/Electronics Standards, Standardization & Quality Control, etc.

NSFC, the premier funding agency for R & D projects in China,

had proposed cooperation between CSIR and Chinese R & D institutions in some of the areas including Global Change, Biological, Physical Sciences, etc. The CSIR delegation visited some of the R & D institutions with a view to identifying specific areas of cooperation between CSIR and NSFC. An understanding was reached with NSFC to conclude a separate arrangement between CSIR and NSFC. Delegations from both SBTS and NSFC are expected to visit CSIR early next year to further work out details of cooperation. □

## India - Bangladesh S & T Cooperation

A science delegation from Bangladesh, consisting of Mr Habibur Rahman, Additional Secretary, S&T Division, as leader and Dr Md. Walliuzzaman, Chairman, Bangladesh Council of Scientific & Industrial Research (BCSIR) and Prof. Nurul Islam, Director, Institute of Appropriate Technology as members, visited India from 29 July to 5 August 1991 to work out a programme of cooperation in S&T between the two countries.

A protocol of cooperation between the Department of Scientific & Industrial Research (DSIR), India and the S&T Division of Bangladesh, was signed on 31 July 1991 by Dr S.K. Joshi, Secretary, DSIR and Director General, CSIR and Mr Habibur Rahman, which assigns the role of future cooperation to CSIR of India and CSIR of Bangladesh. The protocol is a follow-up of the high level exchange visits of Dr A.P. Mitra, the then

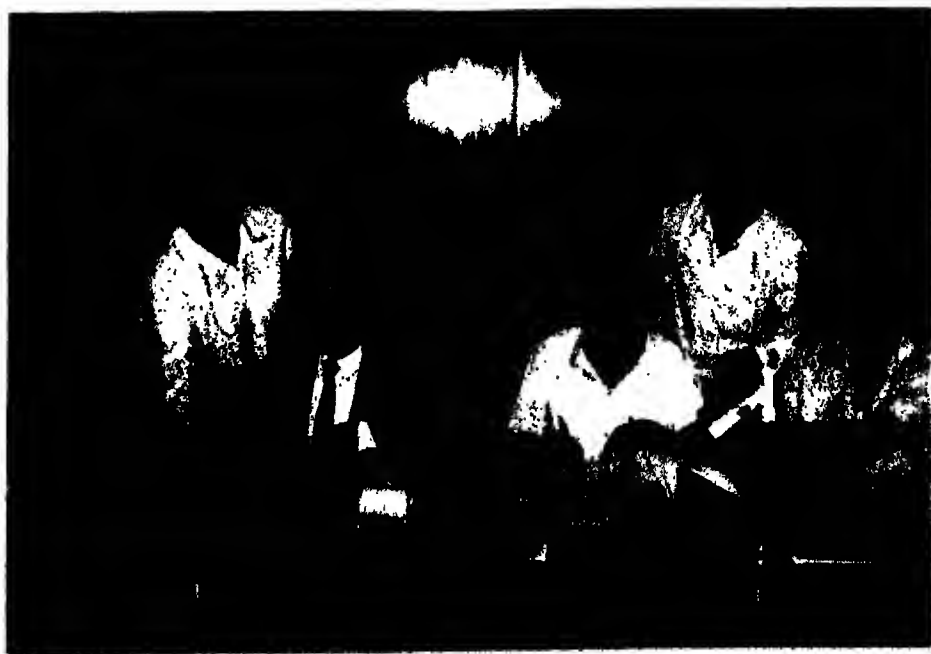
Director General, CSIR to Bangladesh and of Mr Eusuf, Secretary, S&T Division of Bangladesh, to India in 1989.

The Bangladesh delegation visited NPL, CEL and NRDC in Delhi; CDRI, CIMAP, NBRI and ITRC in Lucknow and CGCRI and IICB in Calcutta to identify specific areas of cooperation. A memorandum was signed between CSIR of India and CSIR of Bangladesh by Shri K.N. Johry, Adviser, CSIR and Dr Md. Walliuzzaman, Chairman, BCSIR, on 2 August 1991, in which areas of future cooperation have been listed. These include: Solar Photovoltaics, Bio-Technology including Tissue Culture, Food Technology, Medicinal & Aromatic Plants, Instrumentation, Glass & Ceramic Research and S&T Policy and Management. The BCSIR scientists will also be trained in CSIR laboratories under a long-term fellowship programme. □

## Thermal Stabilization of Rice Bran

The Technology Mission on Oilseeds (TMO) initiated by the Government of India to identify potential sources of oils and take measures to increase the indigenous supply of edible oils, identified rice bran as the most promising existing source. Development of a suitable stabilization process was consequently named a high priority task, which was assigned to the Indian Institute of Chemical Technology (IICT), Hyderabad.

The thermal stabilization process developed at IICT is based on the use of the rota disc processor, a novel thermal processor which enables not only good mixing of solid particles but also a high rate of heat transfer. It consists of a horizontal, steam heated rotating shaft carrying, at short spacings, interconnected discs



Dr S.K. Joshi and Shri Habibur Rahman signing the protocol on S&T Cooperation between India and Bangladesh

with small 'lifters' attached at their periphery to mix the charge vigorously. The shaft rotates inside a steam jacketed trough which carries at one end a hopper for feeding the material which is discharged through a discharge port at the other end. A facility for adding water to the charge as fine spray by way of a feed spout is provided.

As the moist bran enters the processor, it gets quickly heated up due to the rotating hot discs. The bran is continuously agitated and gradually pushed forward and is subjected to efficient and uniform heating. The bran gets adequately stabilized by the time it is discharged from the processor. One advantage of this process is that unlike in many other wet stabilization processes, the stabilized bran needs no drying. On cooling to room temperature, it can be bagged. As moisture is added to the bran before stabilization, the weight loss due to moisture difference is minimum.

A distinct advantage of the process developed is that the colour fixation in the oil from stabilized bran, which is concomitant with thermal processes and which adversely affects the oil quality, is minimized due to the mild conditions employed.

The stabilized bran was found to store well for at least one month without any significant rise in the free fatty acid content in the oil. The increase was only 2-3 units after 4 weeks. The colour of oil from the stabilized bran was quite low and was comparable to that of oil from the control sample. The results were confirmed from the data on stabilized bran samples collected and analyzed by scientists from OTRI, Ananthapur. Over 2 tonnes of bran was stabilized and bulk storage studies were carried out which also confirmed the results with respect to effectiveness of stabilization and refined and bleached oil colour. The stabilized

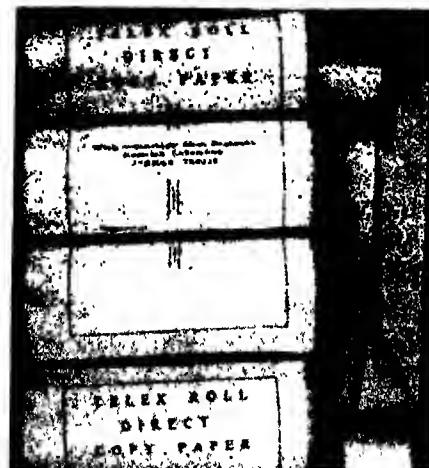
and bulk stored bran was industrially evaluated for extractability, pellet strength and quality of oil. These characteristics were not found to alter as a result of stabilization. The processor has a throughput of 100 kg/h which matches the bran production rate in a 50 tonnes/day rice mill. It is therefore easy to couple with the equipment in a modern rice mill.

The rota disc processor was installed in a rice mill in Hyderabad and the process was demonstrated to rice millers, solvent extractors, equipment manufacturers, representatives of Solvent Extractors' Association of India and Chairman and members of the Rice Bran Stabilization Technologies Evaluation Committee of Mini Mission 11 of TMO. Recently the process was demonstrated to rice millers at Raipur. For further demonstration, the processor was installed and commissioned in the rice mill of M/s M.P. State Cooperative Marketing Federation Limited at Durg (M.P.). Demonstrations are also envisaged in U.P. □

### **Speciality Paper Plant at Karukutty starts production using RRL - Jorhat Technology**

The technology for direct copy paper and heat sensitive paper, developed by the Regional Research Laboratory (RRL), Jorhat, was released through NRDC to the Hi-Tech Paper Co., Karukutty, Kerala, who has set up a unit at Karukutti. The unit, first of its kind in the Kerala State, has started production.

Direct copy paper is used for multiple telex rolls, computer listing papers, airline tickets, etc. Heat sensitive papers are used in recording apparatus, e.g. gas



Samples of direct copy paper

chromatograph recorders, spectrophotometers, GLC, ECG and GPC units and seismological recording instruments.

RRL-Jorhat provided the process know-how including process parameters, raw material requirements and specifications, test equipment, product specifications and analytical procedures, etc. The laboratory also assisted the party in commissioning the plant and in its trial runs. □

### **Harsha — The portable high efficiency multi-fuel chulha**

Solid fuels and agricultural wastes such as charcoal, coal, coal briquettes, fire wood, wood chips, bush, coconut husk, bagasse and cowdung-cake are burnt in conventional chulhas generally in an inefficient manner. These chulhas consume more fuel, produce lot of smoke and are a great health hazard. The Regional Research Laboratory (RRL), Bhubaneswar, has developed a portable high efficiency multifuel chulha, Harsha, which is well suited for rural as well as urban needs. With reduced fuel consumption and almost smoke-



less operation, Harsha is different from other chulhas as it can burn individually or in combination with different fuels and agricultural wastes without choking the grate during the entire period of burning. The volatiles of the fuel burn inside the perforated combustion chamber and the fixed carbon of the fuel burns in the troughs of the corrugated grate at bottom in a two stage combustion process. The waste radiant heat from the chulha surface preheats the air and this air is sucked into the chulha both ways as primary and as secondary air that helps in complete combustion of the fuel. With overall ther-

mal efficiency of 24,33,34 and 42% for coal, firewood, bagasese and cowdung combustion respectively as compared to the 6-12% in the case of conventional chulhas, Harsha chulha's fuel saving is 40-50%.

Under a DNES Plan to produce 18 lakh improved chulhas every year, Harsha chulha is being manufactured by four parties (Orissa-1, West Bengal-2, Uttar Pradesh-1). Till March 1991, over one lakh Harsha chulhas had already been manufactured. Shri S. Khuntia, a Scientist of the laboratory, has won an OREDA award for inventing the Harsha chulha. □

## Theoretical Studies of Molecular Reaction Dynamics

**Dr N. Sathyamurthy's Bhatnagar Prize-winning Work\***

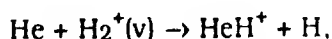
Rates of reactions were beginning to be measured for reagents in selected electronic-vibrational-rotational states and products in specific internal states with relative translational energy of reactants controlled typically under beam conditions. The shift in the eighties was from scalar to vector observables. 'Dynamical stereochemistry' is the preferred usage now. Theory has kept pace with experiment at every stage.

Dr Sathyamurthy and coworkers at IIT-Kanpur have been involved in studying theoretically elementary reactions using classical trajectories and time-dependent quantum mechanical (wave packet) approach as diagnostic and predictive tools. They have correlated the features of potential-energy surfaces with dynamical

outcomes, and have pointed out the interesting role the reagent rotation could play in controlling reaction rates. Whereas small amounts of rotational excitation cause a decline in the reaction cross section (measure of reaction probability) substantial amounts of rotational energy can reverse the trend for several reactions.



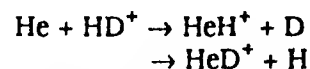
Dr Sathyamurthy and his research group have paid special attention to the understanding of the dynamics of the reaction:



its dissociative counterpart:



and the competition between the two under a wide range of initial conditions. The isotopic branching ratio in



has also been investigated by them. All these they have studied *ab initio*, utilizing the quantum mechanically computed potential energy surface for the system and computing hundreds of thousands of classical trajectories for predicting the observables. Although, the agreement between theory and experiment is excellent in many respects, the study has revealed discrepancies in some of the available experimental results.

Dr Sathyamurthy and coworkers have used the time evolution of quantum mechanical wave packets to follow the dynamics in (He, H<sub>2</sub>) collisions and model H<sub>2</sub>-W collisions. The approach has also been used to predict the spectrum of the transition state for the collinear (H, H<sub>2</sub>) reaction, and to demonstrate that the entropy in dual (configuration and momentum) space rises to a maximum when the reaction is over.

Recently, Dr Sathyamurthy and coworkers have been investigating fractals in atomic and molecular collisions. In particular, they have pointed out that fractals arise in action-angle plots for systems for which there are two possible collisional outcomes, for example, reactive and nonreactive (in the case of a metathesis reaction) or dissociative and nondissociative. The implications to observables in collision experiments are being investigated.

Dr Narayanasami Sathyamurthy (born 17 July 1951) did his B.Sc. (1970) and M.Sc. (1972) from the Annamalai University and Ph.D. (1975) from the Oklahoma

\*Dr N. Sathyamurthy, Professor in the Department of Chemistry, Indian Institute of Technology, Kanpur, has been chosen for the 1990 Shanti Swarup Bhatnagar Prize in Chemical Sciences (along with Dr B.M. Choudary of the Indian Institute of Chemical Technology, Hyderabad) [CSIR News, 41 (1991), 51].

State University, USA. He was post-doctoral fellow at the University of Toronto, Canada, during 1975-78 and Alexander-von-Humboldt Fellow at the Max-Planck-Institut fuer Stroemungsforschung, Gocitingen, FRG, during 1986-87.

Dr Sathyamurthy joined the Department of Chemistry, Indian Institute of Technology, Kanpur, in 1978 as a lecturer and has been a Professor since 1985. Recipient of the Young Scientist Medal (1980) from the Indian National Science Academy, New Delhi, he was selected Young Associate in 1983 and was elected Fellow in 1990 by the Indian Academy of Sciences, Bangalore. He received the Rev. Fr. L.M. Yeddnapalli Memorial Award in Physical Chemistry (1989) from the Indian Chemical Society, Calcutta. He is author of more than 70 research papers and editor of a volume on Reaction Dynamics: Recent Advances, Springer-Narosa, New Delhi (1991). □

### Mutator Genes of *Vibrio cholerae*

Noncomplementary base pairing in DNA occurs either due to replication error or during recombination between homologous but non-identical DNA sequences or due to chemical modification of bases, such as deamination of 5-methyl cytosine to thymine. These mismatches in the DNA, if not repaired, result in high spontaneous mutation frequency. The repair has to be on the newly synthesized strand of the DNA molecule otherwise the error is fixed permanently. In bacteria, the DNA strand discrimination is done by taking the advantage of the fact that methylation is a post-replicative process and the newly synthesized strands are transiently undermethylated. The product of the DNA adenine methylase (dam) gene methylates the adenine

residue at the N<sup>6</sup> position. One of the mechanisms for repairing mismatches in DNA utilizes the dam gene product mediated methyl directed process. Several other mutator gene functions namely the products of mutS, mutH, mutL and mutU are involved in this process. All these gene products act on unmethylated or hemi-methylated DNA and not on fully-methylated DNA.

*Vibrio cholerae* cells are inefficient in repairing UV-induced DNA damage. The spontaneous mutation frequency, however, is comparable to that of other organisms. In view of the fact that the spontaneous mutation frequency is directly related to the ability of a cell to repair mismatches in its DNA, Shri Tapan Kumar Bera, a research fellow at the Indian Institute of Chemical Biology (IICB), Calcutta, examined the status of DNA mismatch repair mechanism in *V. cholerae* cells. In course of his studies, he identified, cloned and determined the nucleotide sequences of the mutL and mutS genes of this organism. He constructed several genomic libraries of *V. cholerae*, and using interspecific complementation of *E. coli* mutS and mutL mutants with the plasmids containing the gene bank, he identified these genes. These mutator genes of *V. cholerae* though functionally complement *E. coli* and *S. typhimurium* mutL and mutS mutants, exhibit high degree of nucleotide sequence divergence. A 2.5 kb fragment of *V. cholerae* genome codes for the mutL protein of molecular weight 62,000. The complete nucleotide sequence of the mutL gene has been determined. A mutL mutant of *V. cholerae* was isolated, which exhibited a high level of spontaneous mutation frequency, sensitivity to UV light and methyl methane sulfonate (MMS). The mutant phenotype could be reversed by introducing the plasmid pJT250,

constructed by Shri Bera carrying the mutL gene of *V. cholerae*. While the spontaneous mutation frequency reverted back to the normal value in the transformed cells, the UV and MMS sensitive phenotype remained unaltered, suggesting that these phenotypes might be due to a second mutation in one of the rec genes. mutS Gene of *V. cholerae* was coded by a 4.7 kb DNA fragment. The product of this gene was found to be a 92,000 Da protein. Partial nucleotide sequence of this gene was determined. Both the mutS and mutL genes were present in all biotypes and serotypes of classical vibrios examined.

Shri Tapan Kumar Bera worked under the guidance of Dr Jyotirmoy Das of IICB, Calcutta, and was awarded Ph.D. degree in Biochemistry by the Calcutta University for his thesis based on the study. □

### NEW PUBLICATIONS

*Special Issue of Indian Journal of Radio & Space Physics*

#### Thirty Years of Scientific Ballooning in India

Dr H.J. Bhabha initiated high altitude cosmic ray studies using cluster rubber balloon system in 1948 at the Tata Institute of Fundamental Research (TIFR). During 1948-54, the High Altitude Studies Group of TIFR carried out a series of balloon flights for cosmic ray measurements and for studies of high energy interactions by flying detector systems to an altitude of about 25-30 km from different locations in India, such as Bangalore, Madras, Delhi and Srinagar, covering geomagnetic latitude range 3°N to 25°N. The cluster rubber balloon system had severe limitations in terms of carrying heavy payloads, reaching higher and predetermined float al-

titudes and in maintaining long float durations. Therefore, the development of zero pressure (ZP) polyethylene balloon was undertaken in 1955 at TIFR and the first successful balloon flight with a cosmic ray payload was carried out from the Osmania University Campus in Hyderabad in 1959, a little over thirty years ago. This may be termed as the beginning of the modern scientific ballooning in India. Since then, the technology of scientific ballooning—balloon design/manufacture, and safe launch of scientific payloads on huge polyethylene balloons—has been developed and is being continuously improved upon.

To commemorate the three decades of modern scientific ballooning, a symposium on 'Thirty Years of Scientific Ballooning in India' was organized at the National Geophysical Research Institute, Hyderabad, during 22-24 October 1990, under the sponsorship of TIFR and ISRO and with the support of CSIR and UGC. The symposium aimed at (i) reviewing various technical and engineering aspects of scientific ballooning, (ii) assessing the achievements in various areas of space astronomy and atmospheric sciences using ZP balloons launched from Hyderabad, and (iii) setting goals for the future. Inaugurated by Prof. M.G.K. Menon, FRS, who had provided an inspiring leadership to the development of the balloon technology at TIFR during its early phase, the symposium had the participation of engineers and scientists from TIFR and several other national laboratories and universities in India. Scientists/engineers from almost all balloon centres in the world, namely, USA, France, Japan, USSR, Australia, Brazil, Indonesia, and representatives of M/s. Winzen International and M/s Raven Industries—balloon manufacturers in USA—also participated in the sym-

posium. Various aspects of current trends in scientific ballooning in the world with a special reference to the balloon flights from the TIFR National Balloon Facility, Hyderabad and the scientific results from the balloon flights were discussed in this three-day meeting. A panel discussion on future scientific ballooning in India was held at the end of the symposium.

The June-August issue of the *Indian Journal of Radio & Space Physics* has been brought out as a special issue covering 36 select papers presented at the above symposium. The issue is expected to serve as a valuable reference for all those working in the area.

The issue (price Rs 125, \$35, £ 22) can be had from: The Sales & Distribution Officer, Publications & Information Directorate, Dr K.S. Krishnan Road, New Delhi 110012.

#### **Publications Index — A record of CBRI publications on Building Materials**

*Publications Index* is a record of publications of the Central Building Research Institute (CBRI), Roorkee, produced during 1947-90, on Building Materials. The publication contains bibliographic details of the papers published/presented, books and other publications brought out by the institute. Details pertaining to 755 publications have been given in a user friendly searching sequence with appropriate indexes.

Enquiries pertaining to the publication (compiled by R.C. Gupta, Krishan Lal and Mitter Sen) may be addressed to the Director, CBRI, Roorkee 247667. □

#### **Prof. B.B. Dhar appointed Director of CMRS**

Prof. Bharat Bhushan Dhar has been appointed Director of the Central Mining Research Station

(CMRS), Dhanbad, with effect from 1 August 1991. He succeeds Dr B. Singh who retired on superannuation after rendering about 29 years of distinguished service at CMRS.



Prof. Dhar (born 9 Jan. 1938, Srinagar) did his B.Sc. in Mining Engineering from the Banaras Hindu University (BHU), Varanasi, in 1960 and joined BHU as a lecturer in the same year. After some time, he left for Canada and obtained his Master's degree and Ph.D. degree (1970) in the Mining Engineering from the McGill University, Montreal. Thereafter, he returned to BHU and became Reader in 1971 and Professor in 1979. At BHU, he also served as Chief Proctor during 1979-81, Head of the Department of Mining Engineering during 1981-83 and 1985-87, Director of Academic Staff College during 1987-91 and Vice-Chairman & Professor in-charge of the Industrial Consultancy Centre, Institute of Technology, during 1988-91.

Prof. Dhar's field of specialization is Rock Mechanics & Ground Control, Mine Environment and Pollution. He has also worked in the areas of Mine Planning and Design, Operations Research and Management. His recent contribution to the mineral industry is the development of numerical modelling technique for the prediction of mine subsidence, linking Rock Mechanics and Ground Control

Research with Environmental Management and Control of Mining Operations. Subsidence prediction has become an integral part of an Environmental Management Plan now.

Prof. Dhar has over 150 papers published in national and international journals and proceedings. He has also edited a book *Environmental Management of Mining Operations* published by Ashish Publishing House, New Delhi.

He was awarded Rajendra Prasad Gold Medal in 1977-78 by the Institute of Engineers, India, Diamond Jubilee Distinguished Alumnus Award of BIU Mining Department (1985), and Cash Award of BIU Executive Council for the dedicated service (1976). He was the first nominated national lecturer in mining engineering in 1984-85 of the University Grants Commission, New Delhi.

Prof. Dhar is a fellow of the Institute of Engineers, India, and member of the International Society of Rock Mechanics and International Tunnelling Association. Also he is General Secretary of Indian Society of Rock Mechanics, Ground Control and Council Member, MGMI (India); Chairman, Institution of Engineers, Varanasi Local Centre; and member of various technical societies.

Prof. Dhar is a widely travelled man and has visited countries like USA, Canada, Romania, Switzerland, UK, Sweden, Norway and Thailand, etc. for attending seminars/conferences and visiting research establishments, mines, etc.

## PERSONNEL NEWS

### Appointments/Promotions

#### Smt. K. Ramachandran

Smt. Kamala Ramachandran, Coordinator, Wealth of India Division, Publications & Information Directorate (PID), New Delhi,

has been promoted as Scientist F with effect from 29 April 1988.



Smt. Ramachandran (born 15 September 1932) holds an M.Sc (1955) degree in Botany from the Kerala University. She began her professional life with a short stint of teaching in the Providence Women's College, Calicut. In 1956, she joined PID in the editorial section of the *Wealth of India*, and was associated with the publication of the well-known encyclopaedia of Indian raw materials, *The Wealth of India*, from its fifth volume onwards. Since 1980 she is heading the Division which is bringing out the revised and updated series of the encyclopaedia, and is also coordinating the work of Monographs and the Research & Specimen Cell attached to the Wealth of India Division.

In 1975, she was deputed to the Royal Botanic Gardens at Kew (UK) under the CSIR-British Council Exchange Programme. At Kew, she worked on updating the nomenclature of plants for the revised edition of the *Wealth of India*. In 1980, she visited USSR and in 1988, attended two international conferences in Bangkok and Singapore where she presented papers. She has edited several monographs including *Cedrus*, *Abies* & *Picea* and *Birds*.

Smt. Ramachandran is a popular science writer and broadcaster. She is a fellow of the Society for Information Science and a member of several professional scientific societies. □

#### Dr Sajid Husain

Dr Sajid Husain of the Indian Institute of Chemical Technology (IICT), Hyderabad, has been appointed Scientist F with effect from 2 December 1990.



Dr Husain (born 15 May 1939) after obtaining his B.Sc and M.Sc. (Physical Chemistry) from the Aligarh Muslim University in 1958 and 1960 respectively joined the erstwhile Regional Research Laboratory (now IICT), in 1960 and worked for a period of one year as a research assistant in the sponsored project 'LTC testing of Ghuhus Coal' sponsored by S.S. Daga Mining Brothers. Subsequently, he joined regular service in RRL in 1961 and worked on several process development projects, viz. utilization of byproducts of coal obtained from LTC process, chlorination of xlenols and LTC tar acids, chlorophenols, *m*-chloronitrobenzenes and 2,4-dichlorophenoxy acetic acid, etc. He obtained his Ph.D. degree in 1966 while working at RRL-Hyderabad under the joint guidance of Dr Husain Zaheer and Prof. A.R. Kidwai, from the Aligarh Muslim University for his thesis entitled 'Chlorination of some xlenols and LTC tar acids'. He worked as a post-doctoral fellow during 1968-70 under the DAAD programme with Prof. Pitcher, University of Karlsruhe, Germany, on the reaction mechanism of acetylene formation through the reaction of carbon and hydrogen

and also cracking of methane. Again in 1976, he visited Germany under the CSIR-DAAD exchange programme and carried out work on high pressure chromatography, column crystallization and zone melting techniques under the supervision of Prof. H. Schildknecht at Heidelberg.

Becoming Head of the Analytical Chemistry Division in 1979, he organized the division in a systematic manner on modern lines for providing more efficient analytical assistance to R & D laboratories, universities and government agencies. He was the first to utilize the Size Exclusion Chromatography (SEC) technique for the characterization of various oils and fats. He studied the quality of oil on defrying, and developed methods for determining adulteration of diesel and kerosene in petrol, using this technique.

He has also carried out extensive work on the utilization of naturally occurring oils and their modified products as stationary phases in GLC. Their properties were evaluated by Inverse Gas Chromatography (IGC). To assess the performance of polymer blends which play an important role in industry, thermodynamic miscibility, compatibility and other thermodynamic properties were evaluated utilizing this technique.

He brought about innovations in the area of chemical technology and environment by the application of process analytical chemistry. The effluents obtained during the production of butachlor, chloropyrifos, *m*-phenoxybenzaldehyde and monochloroacetic acid, etc. were examined and possible methods of treatment were suggested with a view to making the technology pollution-free. Also, he and his group developed a GLC method using ECD for the estimation of ppb levels of ethylene dibromide (EDB)

in black pepper. The method is useful in determining the contamination of black pepper by EDB, a fumigant.

Dr Husain has worked on many consultancy projects. Notable among them are selection of paint systems for reactor building containment coatings for Power Engineering Division, Department of Atomic Energy; studies on disposal of tar residues available in the premises of M/s Union Carbide Ltd, Bhopal (Bhopal gas tragedy); and analysis and monitoring of effluents from drug industries before and after reverse osmosis membrane treatment, sponsored by BHEL (R&D), Hyderabad. He was appointed consultant at Food Technology Department Centre, Bogor, Indonesia, under the Indonesian Nutrition Development Board, during 1982-83. He established a sophisticated analytical laboratory there and imparted training to the personnel.

Dr Husain is a widely travelled man and has visited USA, The Netherlands, Germany, Indonesia, Hungary, Singapore and France. He has presented papers and chaired many technical sessions both in India and abroad. He has published 70 research papers and has 7 patents to his credit. Two students have obtained their Ph.D. degrees, two their M.Phil. degrees, and three students have done their M.Sc. dissertations under his guidance. Presently, seven students are carrying out their research work under his guidance.

A recipient of IDMA award for the paper entitled 'Assay of acetaminophen in tablets by PMR spectroscopy', Dr Husain is a founder member of the Indian Society of Analytical Scientists (Hyderabad Chapter), member of Forum for Science and Technology, Zaheer Science Foundation, Oil

Technologists' Association of India, Catalysis Society of India, Indian Society of Social Sciences and Forum for the Protection of Environment (Government of Andhra Pradesh), Chairman of the Laboratoryware and related apparatus committee of the Bureau of Indian Standards and member of the State Level Committee on Standardization and Quality Systems (Government of Andhra Pradesh). He is on the advisory board of *Oriental Journal of Chemistry*. He has organized many training courses, seminars, symposia and workshops and formulated professional courses of study for universities of Bihar. □

## Honours and Awards

### **Ms. S.G. Prapulla gets ROSTSCA Young Scientist Award**

Ms. S.G. Prapulla, Scientist, Fermentation Technology and Bioengineering Discipline, Central Food Technological Research Institute (CFTRI), Mysore, has been awarded ROSTSCA Certificate of Merit for Young Scientist by the United Nations Educational, Scientific and Cultural Organisation, Regional Office of Science and Technology for South and Central Asia (UNESCO/ROSTSCA) in appreciation of her work in the field of Biotechnology.

Ms. Prapulla's work in the field of fermentative production of microbial metabolites of economic importance has led to the development of a rapid, sensitive and efficient method for the estimation of microbial fats.

This award was instituted by UNESCO/ROSTSCA in 1990 for young women scientists (below 35 years) in the field of basic and applied sciences. □

## Shri S. Arunachalam

Shri Subbiah Arunachalam, Editor, *Indian Journal of Technology*, has been appointed a member of the editorial board of a new academic journal, *Public Understanding of Science*, to be published jointly by the Science Museum, London and IOP Publishing Ltd, UK. The journal will publish work of research and scholarship in the interdisciplinary field of public understanding of science, and will be edited by Prof. John Durant, Professor of History and Public Understanding of Science at the Imperial College; Shri Arunachalam will be an Associate Editor of the journal.

Shri Arunachalam is already serving on the editorial boards of *Current Contents* (PCES edition) (since 1977), *Journal of Information Science* (since 1979), *Scientometrics* (since 1988) and *Annals of Library Science and Documentation* (since 1989). □

## Dr M. Maiti

Dr M. Maiti of the Indian Institute of Chemical Biology, Calcutta, has been nominated as a member of the Indian National Committee for International Union of Pure and Applied Biophysics (IUPAB), for three years from 1 July 1991. □

## PATENTS FILED

92/DEL/91: A device for drying leather in leather industry, D.S. Roosevelt, G. Balaraman, R.B. Mitra, K.S. Jayaraman, K. Parthasarathi and R. Jagadheeswaran — Central Leather Research Institute, Madras.

99/DEL/91: A portable digital soil salinity tester, D.S. Pathania, A.K.

Ganjoo, R.K. Jain, S.K. Pyne and S.R. Gowariker — Central Scientific Instruments Organisation, Chandigarh.

100/DEL/91: A process for the production of leatherboards, D.C. Saikia and B.P. Chaliha — Regional Research Laboratory, Jorhat.

101/DEL/91: An improved aeration device, A.S. Bal, C.G. Malewar, H.J. Patil and A.C. Manuel — National Environmental Engineering Research Institute, Nagpur.

131/DEL/91: A device for on-line sensing, monitoring and display of level of industrial conducting liquids and slurries with current loop interface, T.R. Vasudeva, V.L. Patil, G.K. Gautam, V.D. Bajaj and P. Kapur — Central Electronics Engineering Research Institute, Pilani.

132/DEL/91: An improved process for the preparation of (Z)-11-hexadecenal, J.S. Yadav, T. Shekharam, M.N. Reddy and A.B. Prasad — Indian Institute of Chemical Technology, Hyderabad.

133/DEL/91: Improvements in or relating to the electrochemical preparation of aluminium hydroxychlorides, M.M. Rao, S. Pushpavanam, S. Mohan, and K.C. Narasimham — Central Electrochemical Research Institute, Karaikudi.

134/DEL/91: A process for the preparation of phosphated and sulphated fatliquors based on marine, animal and vegetable oils, K.I. Vijayalakshmi, G. Baskar, V.V.M. Rao, K.S. Jayaraman, S. Rajadurai, G. Thyagarajan and K. Parthasarathi — Central Leather Research Institute, Madras.

135/DEL/91: A process for the preparation of hydroxylated fatty acids and esters from long chain paraffins C14-C30, K.I.

Vijayalakshmi, G. Baskar, V.V.M. Rao and S. Rajadurai — Central Leather Research Institute, Madras.

136/DEL/91: A process of making anionic acid stable fatliquors based on highly unsaturated oils, K.I. Vijayalakshmi, G. Baskar, V.V.M. Rao, K.S. Jayaraman, S. Rajadurai and G. Thyagarajan — Central Leather Research Institute, Madras.

137/DEL/91: Natural fibre reinforced rubber composite, P. Rajalingam and G. Radhakrishnan — Central Leather Research Institute, Madras.

138/DEL/91: A process for the chemical modification of PVC for better thermal stability, G. Radhakrishnan and P. Rajalingam — Central Leather Research Institute, Madras.

139/DEL/91: A process for the preparation of cross-linked water borne acrylic top coat for leather, P. Rajalingam, G. Radhakrishnan, C. Muralidharan, K.S. Jayaraman and P. Saravanan — Central Leather Research Institute, Madras.

140/DEL/91: A process for the preparation of moisture curable polyurethane coating for leather, G. Radhakrishnan, P. Rajalingam, K. Parthasarathi and B. Ramanaiah — Central Leather Research Institute, Madras.

141/DEL/91: A process for the preparation of phosphated sulphated fatliquors based on marine oils, animal oils and vegetable oils, K.I. Vijayalakshmi, G. Baskar, V.V.M. Rao, K.S. Jayaraman, S. Rajadurai, G. Thyagarajan and K. Parthasarathi — Central Leather Research Institute, Madras. □



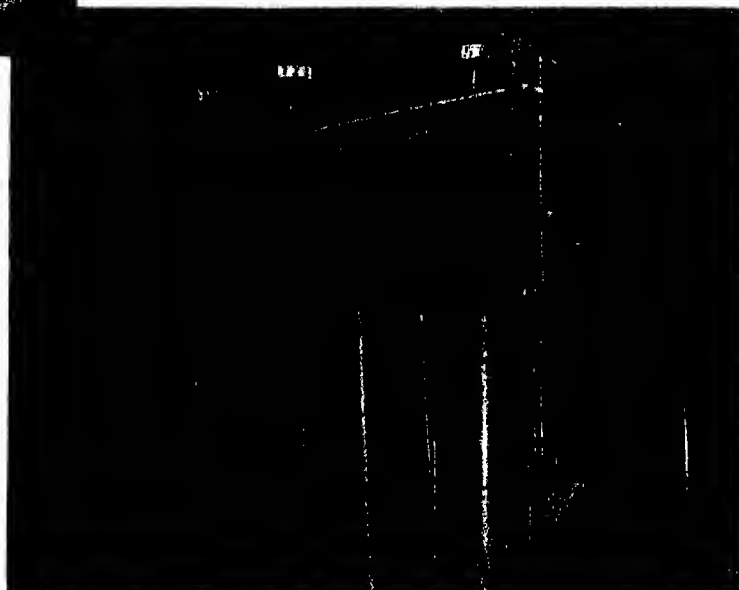
# CSIR NEWS

19/07/91



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Computerized Control of Tannery Wet Operations (clockwise from top left) : Process computer & field terminal box, Processed skins being checked, Tannery wet operations control systems overview, and Product weighing tank (p. 198 ).

# Microprocessor based Multiplexed Data Monitoring System for Underground Coal Mines

In coal mines, methane and carbon monoxide gases, unstable strata conditions, etc. many a times lead to serious accidents, and therefore their monitoring is of vital importance. Another important factor which needs monitoring is the condition of the mining machinery such as coal cutting machines, pumps and fans. This is necessary not only for mine safety but also for increasing productivity in mines.

For an effective monitoring for the various mine safety parameters, the Central Mining Research Station (CMRS), Dhanbad, has designed, developed and fabricated a microprocessor-based eight bit, eight channel data acquisition system. This system has been designed around INTEL's 8085 microprocessor with other programmable, interfacing chips such as 8255, 8251, 8253, etc. along with RAM and EPROM. The eight analogue voltages from eight different sensors are connected to 0809, an eight bit CMOS ADC. The digital values from eight different channels are scanned regularly with the help of microprocessor and data are stored in eight different locations of RAM, 6116. The dedicated monitor programme has been stored in EPROM (2716) with 0000 location. The 8255 has been utilized for alarm annunciation but this input or output device can be connected to DAC, stepper motor switching circuitry and other control hardware. For communication, IC 8251 (Universal/Synchronous/Asynchronous/Receiver/Transmitter USART) has been employed in the design, which is compatible with RS232C/MODEM and other universal communication systems.

The system has been configured as an intrinsically safe cir-

cuit, so that it can be applied directly to mines. It has flexibility and adaptability to computer-based telemonitoring systems. It enables a single operator to have close surveillance of the entire mine condition. Besides environmental conditions, the system can provide monitoring for various items of mine machinery such as pumps, fans, motors, health of mine machines, switchgear, power distribution, etc.

A suitable dedicated data acquisition software in assembly language has also been developed, which can perform scanning of channels, temporary data logging, limit checking, annunciation of alarm, etc. The programme had been 'burnt' in EPROM 2716 (2 KB) and efforts have been made to incorporate as much as possible in software to reduce the dependence of the hardware. The programme has been segregated into various sub-routines for input to ADC loop and transmission of stored data using Asynchronous mode with one start and two stop bits.

A suitable intrinsically safe 'power supply' has also been developed to provide analogue +5V, 0, -5V; and digital +5V, 0, -5V, which is capable of feeding all the electronic modules and sensors in underground coal mine.

A suitable intrinsically safe MODEM has been developed, modifying a commercial modem. This can transmit the underground digital data stored in RAM to a remote place in the form of frequency (FSK technique). The total computerized system thus designed and developed has been put to field trial in a colliery. The central station at surface is a personal computer (with 8088 CPU) with monochrome display and floppy

disk drive. Basically there are two technical tasks for which the computer has been found suitable:

(a) The data acquisition and processing task involves the reception of analogue and digital signal transmitted from various underground sensors to the computer for storage and subsequent processing. In the present system digital data are transmitted to the surface computer using frequency shift keying technique. The data received at surface are further converted to digital values using demodulator. The modem at surface is directly interfaced to the surface computer. The data are further processed using commercially available data acquisition software in BASIC language.

The programme which is in diskette is loaded to the memory system of personal computer for processing of data.

(b) The system is completely programmable in terms of underground parameters, its limit checking, linearization, scan interval, channel skip and annunciation of alarm. Various modes such as demand log, daily log, hour curve, day curve, etc., are all available as per the key command and can provide both visual display and hardcopy printing.

The present development is likely to have great impact in the field of distributed networking for wide area monitoring and control of underground environmental parameters. □

## Microcomputer-based process control system for tannery wet operations

The competition in leather industry is forcing the industry to improve

the quality of products, increase productivity, conserve chemicals and energy. To achieve this is an uphill task for the industry unless it switches over from the conventional manual processing to computerized processing. With the availability of low-cost microprocessors having abundant computing power, many industries like steel, paper and pulp, sugar, etc. are now using these for controlling the various operations involved.

The Central Electronics Engineering Research Institute's, Madras Centre and the Central Leather Research Institute, Madras, have jointly developed a computerized process control system for tannery wet operations, which is ideally suited for small and medium scale tanneries.

Tanning is a very slow process and runs for hours. Although various tanning operations are sequential in nature, for certain operations like hot water and chemical additions, closed loop control in addition to monitoring, may have to be incorporated. However, 90% of the tannery operations require just monitoring of critical parameters. These operations relate to: water addition into drum; control of chemical additions (based on pH values) into drum; preparation of solutions like fat liquor, formic acid and their addition

into drum; control of drumming times, durations and speeds and maintenance of desired temperature during retanning, dyeing and fatliquoring stages.

The CEERI Madras Centre interacted with the process personnel of CLRI, studied the process, developed the microprocessor based system — both hardware and software, and helped integrate the system with the CLRI pilot tannery to enable the field trials.

The process control system developed includes a PC-AT with appropriate support hardware, and it is being tested on a single drum in the pilot plant of CLRI. The functioning of the system has been demonstrated to a few tanners. With this system, it is now possible to supervise and monitor the water and chemical additions. The system can operate up to 8 drums in a tannery, in a centralized fashion. All components used in the system are indigenously available.

It is envisaged to transfer the technology shortly to prospective entrepreneurs. □

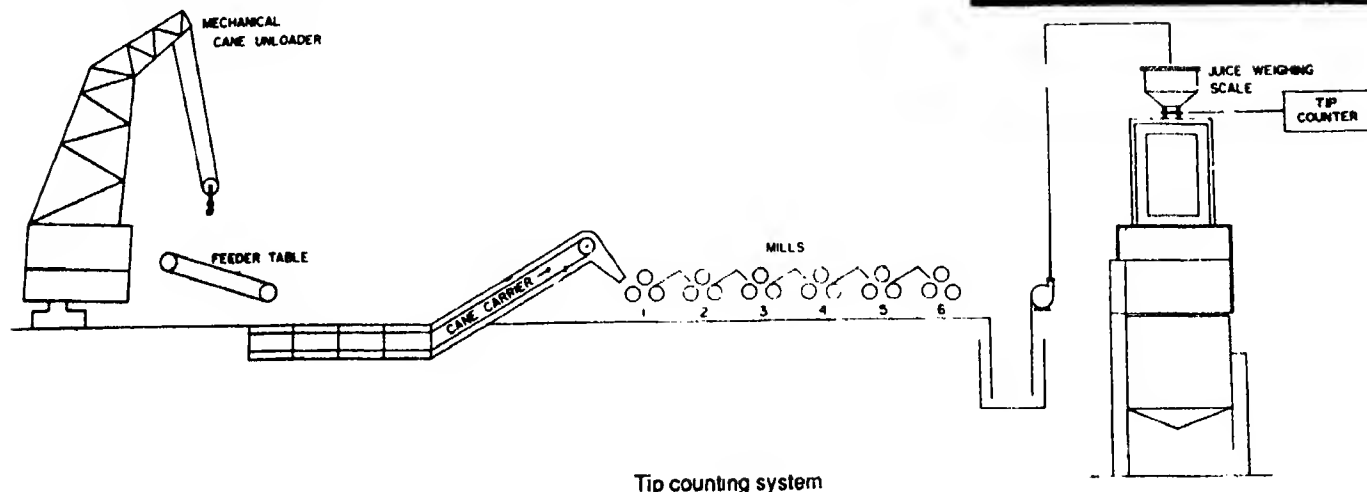
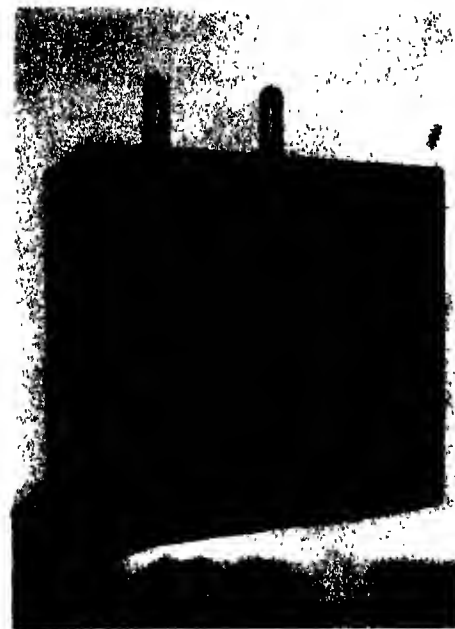
## Tip Counting System

The Central Scientific Instruments Organisation has developed a tip counting system which has wide applications in industry where a

count of discharge operations is required, for example in sugar, fertilizer and chemical industries.

In sugar mills, the raw juice obtained after crushing sugarcane is pumped into a huge container. This container, after achieving certain fixed weight, discharges the juice into another container, placed down below, automatically. The number of times this event (tip) happens in an hour gives the crushing efficiency of the mill. This information should be accessible to all concerned, right from mill manager at the top level to manual labourer at the bottom level.

The system developed provides the display of tip counting on a 365mm by 310mm (14" x 12") front panel. It consists of: Jumbo display



Tip counting system

with LED's of 2 digits (each digit of 270 mm by 130 mm). Crystal controlled one hour clock CMOS circuits, CMOS digital decade counters and display drives, AC/DC to TTL output opto isolator for event sensing as 24V AC input, Signal sensing arrangement either by limit switch or proximity switch or infrared high beam photo electric switch, Inbuilt test signal circuitry, Battery backup, Parallel signal transmission driver for computer hook up, and Resetting facility from computer. The system will be installed at M/s. Ponni Sugars, Erode, shortly. □

### **Suitability of the coke formed by LTC of North Eastern Coals for Cement Production**

The North Eastern Coals contain high volatile and low ash in contrast to their fixed carbon value. These coals have found very limited use owing to their high sulphur content, although they have very good coking index. Most of the sulphur is present in organic form, making its removal by general mechanical means a complex task. The sulphur content of these coals varies from 2 to 7%.

Under a project sponsored by the North Eastern Council, Shillong, the Regional Research Laboratory (RRL), Jorhat, studied the suitability of the coke obtained from low temperature carbonization of these coals for cement making by the vertical shaft kiln (VSK).

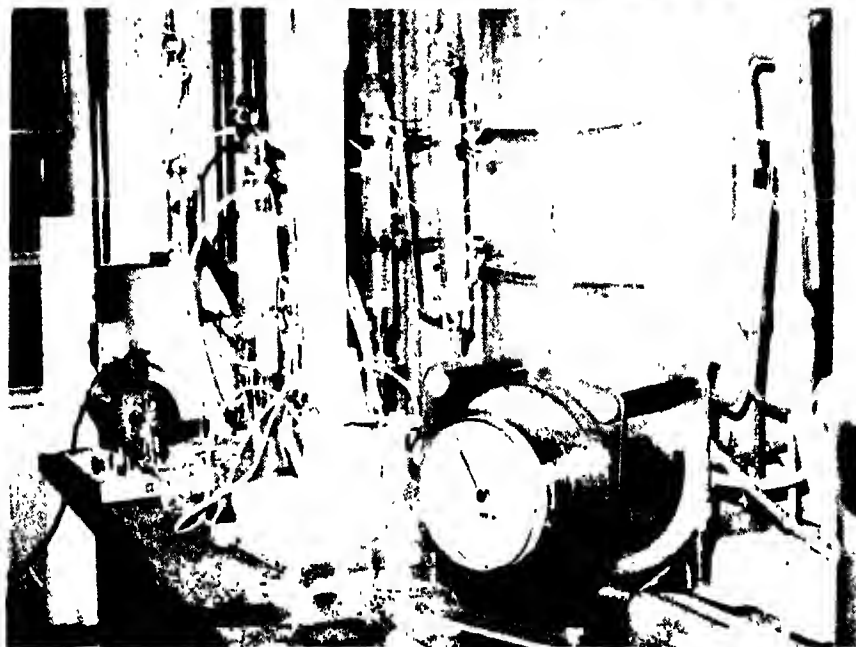
The project involved carbonizing the coals from North Eastern coalfields in the temperature range 550-800°C (low to medium temperature range), testing residual sulphur in coke matrix and checking its reactivity.

The coal samples, after proximate and ultimate analysis,

were carbonized first in a 2 kg/batch unit and then in a 50 kg/batch pilot plant. Four temperatures between 550° and 800°C were chosen to obtain a fairly good correlation over the experimental temperature range. The cokes formed were ground and fired in a vertical shaft kiln to produce cement by dry process. Volatile content of the resultant

cokes at various temperatures was studied. The cement quality was determined through the usual, hardness testing. The byproduct tar was distilled at 350°C to separate pitch component and then its composition was determined.

Based on the studies, a report has been submitted to the sponsor, the North Eastern Council. □



50 kg/batch and 2 kg/batch coal carbonization units at RRL-Jorhat

## Improved Two-stroke Engine for Two and Three-wheelers

Conservation of energy and environment are important issues in the present times. India being a net importer of petroleum crude, it has to accord utmost priority to fuel conservation, particularly in the road transport sector as almost 56% of total petroleum products are consumed in this sector. On the other hand, due to a high growth in vehicle production, particularly scooters, mopeds and passenger cars in the last few years, the large cities are already facing air pollution problem caused by vehicular emissions. Thus, it becomes imperative for us to find solutions which would result both in the reduction in emissions and fuel consumption of vehicles.

The environmental loadings of CO, HC, NO<sub>x</sub> and particulate matter pollutants in the country owing to vehicular emissions, estimated for 1989, are approximately 15.2, 6.3, 5.6 and 1.3 lakh tonnes, respectively. By the year 2000, if no emission controls are adopted, emission of each pollutant will become 2-2.5 times of the present level. Therefore to restrict vehicular air pollution even to the present level, almost 50 to 60% reduction in total emission of each pollutant is required. However, as a large fraction of existing vehicles having uncontrolled emission would continue to operate even in the year 2000, emission standards requiring even more than 60% reduction will be necessary to maintain the total vehicular pollution at the present level.

Moderate to large reductions in vehicle emissions have been possible by those technologies which also result in fuel economy. However stringent controls, particularly those related to nitrogen oxides, require the technologies which may result in poor fuel economy.

Two- and three-wheelers in India are mostly powered by two-stroke engines because of simplicity of their design, low-cost, high power-to-weight ratio and ease of maintenance. An inherent drawback of the conventional design is short-circuiting of 15 to 40% of fresh fuel-air mixture directly to the exhaust resulting in very high hydrocarbon emissions and poor engine efficiency. More than 65% of total vehicular hydrocarbon emissions are estimated to emanate from these vehicles in the country.

The conventional two-stroke engines cannot be run on very lean mixture as the high amount of residual gases in the combustion chamber reduces the speed of flame propagation. Improvements in the carburettor design, ignition system and optimization of port design and timing etc. provide only small reductions in the unburned hydrocarbon emissions.

Engine prototypes employing in cylinder fuel injection, eliminating short circuiting of fuel-air mixture as the scavenging is carried out by air only, have been developed by several researchers world over. Their adoption to 2-wheelers is still under development. These engines have a high potential for fuel economy improvement as well as reduction in unburned hydrocarbons.

The Indian Institute of Petroleum (IIP), Dehra Dun, has developed a two-stroke engine with a novel intake system consisting of two parallel intake circuits. The additional circuit supplies air alone to the transfer passages through non-return valve(s). It reduces mixture short circuiting as the scavenging is preferentially done with air alone. It is a relatively low-cost modification and reductions up to

40% in HC and a fuel efficiency improvement of 10-12% have been obtained in the laboratory prototype. □

## Offshore Platform and Marine Electrochemistry Centre of CECRI at Tuticorin Harbour

Fouling of industrial equipment and structure is one of the major factors which affect their life and performance. Fouling can be broadly grouped under two classes: (i) microfouling and (ii) macrofouling. Microfouling is associated with adhesion and growth of microorganisms at metal-solution interface, while macrofouling is due to the attachment and growth, mostly of marine organisms like algae, barnacles, molluscs, oysters, ascidures etc. Microfouling, even upto a thickness of few micrometers, reduces heat transfer in cooling systems by as high as 40%, besides causing what is known as microbiologically induced corrosion (MIC). Annual losses due to biological corrosion (mainly buried pipelines) have been estimated at \$500 to 2000 million (1954) in USA and pound 20 million (1956) in U.K. Different types of bacteria cause corrosion by various mechanisms ranging from formation of differential aeration cells to production of aggressive environments through chemical changes.

Macrofouling is a major problem in marine environments and is dependent on such factors as geographic location, temperature and composition, influence of wave action, depth, nature of sea-bed etc. The loading of structures, due to biomass can be as much as 40 kg/m<sup>2</sup>/year and it is reported that a 15 cm thick growth needs additional 50 mm of steel for offshore platforms adding to the estimated

cost proportionately US Navy alone is reported to be spending \$800 million (1986) annually to maintain structures free from fouling.

Apart from the mechanical factors like loading of structures, reduction in cruise speed of sea-going vessels, blocking of intake pipes and channels, etc., the macrofouling leads to accelerated corrosion through various means such as formation of differential aeration cells, production of hydrogen sulphide, increase of oxygen at the surface, providing conditions for growth of anaerobic bacteria etc. Marine fouling can also affect the performance of cathodic protection systems by blocking the anode.

Fight against corrosion in marine environment is akin to guerilla warfare needing a constant vigil. Chemical industries, power plants, concrete structures, ships and port structures and plant near the coastline all face corrosion problem. Studies on the mechanistic aspects of biofouling and its control have led to interesting technological developments. For example, the study on the mechanism of adhesion of marine organisms on surface has led to development of resin for use in underwater painting. Biodegradable plastics, corrosion inhibitors, etc., are other developments.

The Central Electrochemical Research Institute (CECRI), Karaikudi, has established a research centre called OPMEC (Off-shore Platform and Marine Electrochemistry Centre) in Tuticorin harbour in the southern part of the east coast of India for investigations on marine corrosion and biofouling.

The Centre has facilities to study various aspects of marine corrosion, biofouling and their control. Already considerable studies have been carried out with regard to characterization of marine organisms and extent of biofouling as well as evaluation of corrosion behaviour of different materials under static and flow conditions. A number of sponsored programmes for various agencies have been undertaken and are in progress at this Centre. It is proposed to add facilities for stress corrosion cracking in seawater environment under natural conditions, as well as for basic studies relating to biofouling.

CECRI would welcome users of these facilities, either through sponsored programmes with CECRI or through appropriate contract programmes between the user and CECRI. It is hoped that this unique facility will be fully exploited not only by the R&D institutions in India but also in other countries. □

## **Burning Behaviour of Metal Powder Fires and Their Extinguishment**

Aluminium and magnesium, in finely divided form, are widely used in the paint and explosive industries, in industries of the defence sector and in the processes where high temperatures are needed. Aluminium is extensively used as a high calorie fuel while magnesium alloys are widely used in the aircraft industry. These metal powders on ignition undergo an exothermic reaction liberating

considerable amount of heat. Reactivity of these powders is so high that they continue to burn even in the presence of nitrogen, forming their nitrides. Mishandling of these may therefore lead to serious fire hazards. Open flame, light, smoking, welding, cutting or drilling/chipping which may emit hot particles are prohibited in areas where aluminium or magnesium dust is produced.

The Central Building Research Institute (CBRI), Roorkee, undertook studies to understand the burning behaviour of powders of magnesium, aluminium and their alloys, and extinguishment of the fires caused by burning of these powders. The powders were taken in the form of heaps which were ignited by gently placing 2 g of burning magnesium powder in a small shallow cavity at the top of the heap. The results of the various studies are presented here.

The DTA and TGA plots of magnesium and aluminium-magnesium alloy powders show two exothermic peaks for each powder. A sharp increase in TGA curve is observed against each peak for both the powders, implying distinct weight gain. In case of aluminium powder, a broader exotherm is followed by an exothermic peak showing that it liberates heat and melts just after ignition.

Burning behaviour of magnesium and aluminium-magnesium alloy powders are similar but differ distinctly from that of aluminium powder. For magnesium and aluminium-magnesium alloy powders, fire spreads down uniformly all over the top surface layer, before the burning front moves in layer gradually and uniformly from the top to the bottom surface layer, leading to the formation of oxides. The resulting differential tension, due to shrinkage in the burnt powder layers, lifts the edges of the heap at the interface between sand bed and the powder heap. Lifting and thermal stresses in the burnt layers give rise to development of cracks, allowing entry of air into the powder heap to sustain and help the burning process.

For aluminium powder, however, fire does not spread all over the top surface layer of the heap. Instead, the fire confines within a small area around the cavity. In this case, the burning front is like



a cylindrical column, which moves rapidly downward through the heap. Since large amount of heat is liberated during combustion, the moving burning front transfers heat to the adjacent layers axially and laterally. Thus the burning front is enlarged and the process continues. Further, the movement of the burning front results in the formation of peripheral cracks, which allow entry of air to sustain burning.

Burning behaviour of metal powder heaps on different beds has been characterized by measuring temperature-time distribution at several X-Y-Z locations within the heap. It is found that the temperature-time distributions are almost alike for the magnesium and the aluminium-magnesium alloy powder heaps, but this differs in the case of aluminium powder heap.

Fires of aluminium powder heap are found most severe as revealed by the fact that highest temperature is attained at the top surface layer.

Quantitatively, there is a significant effect of the burning behaviour of magnesium powder heaps on the sand bed. The burning behaviour of 25, 50 and 75 g powder heaps has been found different from that of 100, 200, 400 and 800 g powder heaps. For 25, 50 and 75 g powder heaps, maximum temperatures of the top surface layer are always higher than the corresponding temperatures of the bottom surface layer. In contrast, reverse is true for 100, 200, 400 and 800 g powder heaps. For 400 and 800 g powder heaps, burning takes place with flames of height up to 225, 300 mm. This also indicates that burning of large amount of magnesium powder fires can be hazardous.

Physico-thermal properties of the material beds, their dimensions and shapes, on which the heaps of magnesium powder are formed or that of containers in

which the powder is stored, also play a prominent role. Materials with high thermal diffusivity result in retardation of the maximum temperatures of both the top and the bottom surface layers. Maximum temperatures of both the top and bottom surface layers are always higher for the powder heap on insulating beds than on heat conducting beds. Similarly, time of burning is always higher for the powder heap on insulating beds than on heat conducting beds.

After the burning of metal powder heaps, the constituents of various combustion products have been determined through X-ray diffractometer. The oxide and nitride have been found to be the predominant fraction of the com-

bustion products. Interestingly, the combustion products of aluminium, and aluminium-magnesium alloy powder heaps on the sand bed are found to contain free aluminium also.

For extinguishment of fires of the heaps, different dry chemical extinguishing agents have been evaluated to choose the most effective one. It is noted that zinc stearate: sand mixture of 30:70 ratio is the most effective extinguishing agent in combating fires of all the metal powders. However, the amount of the agent required for the extinguishment of fires of aluminium heap is double of that required for magnesium and the alloy powder heaps. □

## From Fuzzy Sets to Pattern Recognition

**Prof. S.K. Pal's Bhatnagar Prize-winning Work\***

Prof. Sankar K. Pal's contribution in the field of Pattern Recognition, in broad sense, relates to the development of theory, formulation of algorithms, and demonstration of their success in real life problems using both classical and fuzzy set theoretic concepts. A brief account of his work is present here:

He formulated the fuzzy set theoretic approaches for pattern recognition and image processing problems when the pattern indeterminacy (ambiguity) is due to inherent vagueness rather than randomness. The classifiers designed do not need assuming any distribution for the pattern classes. They can handle linguistic input statements based on the theory of approximate reasoning

and provide, unlike traditional decision, natural (soft) output along with its degree of certainty. Algorithm has been developed for



determining multiclass (fuzzy) boundary and shape of a pattern class from its prototypes. The syntactic classifier (developed using fuzzy and fractionally fuzzy grammar, and fuzzy primitives) enables one to work with a smaller number of primitives and to use, unlike the ordinary grammars, the same set of production rules and terminals for every class.

\*Prof. S.K. Pal, Electronics & Communication Sciences Unit, Indian Statistical Institute, Calcutta, has been chosen for the 1990 Shanti Swarup Bhatnagar Prize in Engineering Sciences (along with Dr Gangan Prathap of the National Aeronautical Laboratory, Bangalore) [CSIR News, 41 (1991) 51].

Fuzzy geometry, entropy and other information/fuzziness measures have been used to develop algorithms (together with mathematical framework) for image segmentation, edge detection/enhancement, primitive extraction, skeletonization and clustering to result in both fuzzy and crisp output. This avoids committing oneself to a specific hard decision for ill-defined input. Its extension to hybrid coding and colour image processing has also been made.

The aforesaid measures for spatial ambiguity and grayness ambiguity have been optimized to provide quantitative indices for image processing operations and feature evaluation problems in order to avoid visual subjective judgement on image quality (and human intervention) by making the task objective.

Various fuzzy set theoretic operators/tools have been defined in order to make the task of analysis and recognition effective. These include, correlation between membership functions, new generalized definitions of union, intersection and inclusion operators (considering the sense of membership function and measure theory), index of area coverage, fuzzy medial axis transformation, bounds for membership functions and spectral fuzzy sets. The bound functions and special fuzzy sets enable to reduce the uncertainties in assessing membership value and to make the fuzzy set theoretic approach enough flexible.

New definitions of classical entropy have been introduced based on exponential behavior of gain, and the definitions of various image entropies. The image entropy measures include local, conditional, positional, hybrid and higher order fuzzy entropy. These information measures take care of the dependency of pixel intensities, probability and possibility dis-

tributions of pixel, collective pixel property and location of an object in the scene. Various algorithms for quantitative scene analysis and robot vision problems have been developed using these measures.

A new concept of self-supervised learning (GGA) has been introduced based on 'generalized guard zone' along with its stochastic convergence, dynamic behavior, and automatic selection of threshold (optimum dimension of guard zone) and its bounds. In the absence of an external supervisor or any higher level knowledge, the system can reject the outliers (doubtful or mislabelled samples) from the parameter estimation procedure; thus providing always an improved performance as compared to usual non-supervised recognition.

The problem of extracting automatically the valid edge points from the conventional edge output has been tackled using the characteristic of human visual system. This characteristic also provides contrast and homogeneity measures of image regions for their extraction. Formulation of approximate but efficient methods of image coding using quadratic Bezier approximation technique and Bresenham's polynomial constitutes another part of his contribution.

Neural networks have recently been used to find the maximum-a posteriori (MAP) estimate of a scene modelled as a Gibbs random field. The MAP estimation problem which is computationally prohibitive has been solved using a modified version of Hopfield's neural networks. Relaxation algorithms for object extraction have been developed, which optimize objective functions that can be mapped as the energy function of a Hopfield type network and Kohonen's self-organizing network. These algorithms work well in noisy environment. Concept of

fuzzy sets has been incorporated at various stages of Kohonen's network and multilayered perceptron to handle imprecise/incomplete input data for classification.

The above mentioned theories have been demonstrated for recognition of speech, speaker, skeletal growth of children from X-ray, abnormalities in brain neuro-secretory cell, hand written characters, various rocks from landsat imagery data and mango varieties from their leaves.

Research is going on to implement these theories for the management of uncertainty in space station autonomous operations (e.g. space shuttle proximity operations, satellite servicing and camera tracking in orbital operation, and Mars rover control for sample collection) where the tasks of pattern recognition interact with and support the control problems. The objective is to support unmanned mission by modelling the human capability of common sense reasoning in decision-making tasks.

Dr S.K. Pal (born 13 September 1950) obtained his B.Sc. (Hons) in Physics and B. Tech., M. Tech. and Ph.D. in Radiophysics and Electronics in 1969, 1972, 1974 and 1979 respectively from the University of Calcutta. In 1982, he received another Ph.D. in Electrical Engineering along with DIC from Imperial College, University of London, U.K. He got Commonwealth Scholarship in 1979 and MRC (U.K.) Post-doctoral Award in 1981 to work at Imperial College, London. In 1986, he was awarded Fulbright Post-doctoral Visiting Fellowship to work at the University of California, Berkeley and the University of Maryland, College Park, U.S.A. In 1989 he received an NRC-NASA Senior Research Award to work at the NASA Johnson Space Center, Houston, Texas, U.S.A.

At present he is working as a Guest Investigator in the Software Technology Branch, NASA Johnson Space Center. He served as a Professor-in-Charge of the Physical and Earth Sciences Division, Indian Statistical Institute during 1988-90. He was also a Guest Lecturer (1983-86) in Computer Science, Calcutta University.

His research interests mainly include Pattern Recognition, Image Processing, Artificial Intelligence, Neural Nets, and Fuzzy Sets and Systems. He is a co-author of the book: *Fuzzy Mathematical Approach to Pattern Recognition*, John Wiley & Sons (Halsted Press), 1986 which received the Best Production Award in the 7th World Book Fair New Delhi. He has 140 research papers, including 10 in edited books and 85 in international journals, to his credit. He has delivered lectures relating to his research work at various U.S. and Japan universities/laboratories.

Dr Pal is a Reviewer of the *Mathematical Reviews* (American Mathematical Society), a Senior Member of the IEEE, a Fellow of the

IETE, a Life member of the Indian Statistical Institute and Treasurer of the Indian Society for Fuzzy Mathematics and Information Processing (ISFUMIP). □

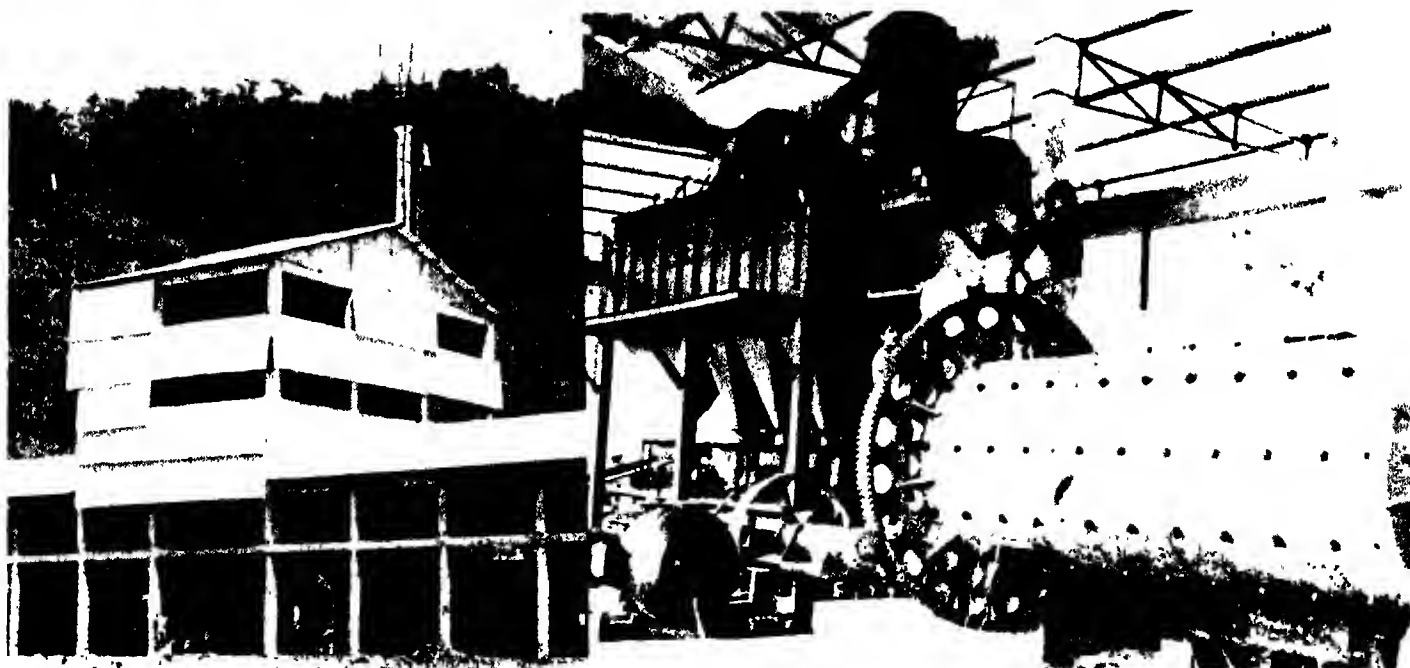
## PROGRESS REPORTS

### RRL-Jorhat Annual Report 1989-90

The Regional Research Laboratory (RRL), Jorhat's R&D activities under the national and societal missions pertained to drinking water, wasteland development, popularization of agrotechnologies and low-cost housing. Five processes i.e. agrotechnology for Java citronella, and mushroom and technologies for deoiler (a flocculant for effluent treatment), gummed paper tape and printing ink, were released to 16 parties directly through the laboratory while one process on the pesticide phosphamidon was released through NRDC. Nine new parties went into commercial production for the first time and manufactured products worth Rs 70 million. A total of 76 processes had been

released to 416 parties till the period covered by the report. Turn-key consultancy services and technical assistance were rendered by the laboratory to M/s Prag Shiva Cement (P) Ltd, Guwahati, and M/s Udayana Cement (P) Ltd, Lanka, Assam for erection and commissioning of 25 tonnes/day VSK cement plants. During the year, the laboratory earned Rs 7.24 million through its contract services, out of the total external cash flow of Rs 16.71 million.

The work on drinking water mission allotted to the laboratory during the seventh Five Year Plan was completed. The work included training manpower development in the north eastern region and evaluation of drinking water sources for problem villages of Assam and Manipur. Nine persons sponsored by governments of Arunachal Pradesh, Assam, Manipur, Meghalaya, and Nagaland got trained on water quality assessment based on chemical and microbiological parameters necessary for potable water. Altogether 471 water sources from different parts of Assam and Manipur were



Prag Shiva Cement (P) Ltd, Guwahati and Udayana Cement (P) Ltd, Lanka's mini cement plants based on the RRL-Jorhat VSK technology under trial

evaluated. The data were used by the respective governments for installation of water purification plants. A field demonstration for assessment of water quality was arranged in Baghchung block of Jorhat district. The guidelines for establishing a laboratory for evaluation of drinking water quality at Imphal, Manipur, were provided.

Based on the cultivation technologies of the economic crops provided by the laboratory, 56 hectares of wasteland were covered under plantation. The beneficiaries mostly belonged to schedule caste and tribe categories. The inclusion of newly added areas brought the total coverage of wasteland of north eastern region under cultivation to 3080 hectares.

The laboratory developed a prototype of a bamboo splitting

machine which would be of immense use in the rural areas.

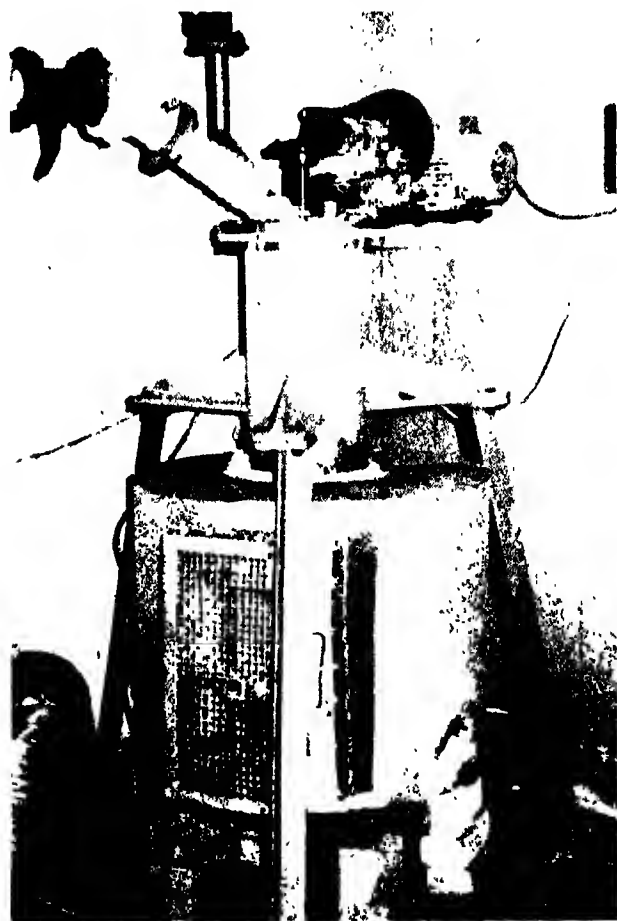
Deoiler is a flocculant for effluent treatment. The process for the production of deoiler, which is a cationic polyelectrolyte, was completed on pilot plant scale. A new S.S. reactor assembly was installed in the pilot plant with a batch capacity of 200 kg product. The process was released for commercial production. The unit was commissioned successfully and 20 tonnes of the deoiler polymer product were produced within a period of seven months.

Both abate and oxydemeton are organo-phosphorus insecticides. Synthesis of demeton methyle was achieved starting from ethylene oxide, ethylemercaptan and *o,o*-dimethyl triphosphoryl chloride. Its conversion to oxydemeton methyl was under

study. Similarly, the synthesis of abate was achieved. The optimization studies were continuing.

Acephate and methamidophos are good organo-phosphorus insecticides and their present demand in the country has been estimated to be 200 tonnes per annum. A new catalyst was developed to convert methamidophos, which is an intermediate in acephate synthesis, to acephate.

Under the studies made on medicinal plants, maximum damage (71.4%) of tube rot in *Dioscorea floribunda* was observed in the month of February. Carben-dazim (1000 ppm) was found to be very effective in minimizing the percentage loss in tuber in *D. floribunda*. In Java citronella, maximum infestation of stem borer and termites was found to be during late September- early October.



Primary tar distillation unit 10 litres/batch at RRL-Jorhat. Samples of printing ink manufactured by Luit Udyog, North Guwahati, Assam, based on the technology developed by RRL-Jorhat

Artemisinin, an antimalarial drug, is active against those strains of *Plasmodium falciparum* which are resistant to other antimalarial drugs such as chloroquin, etc. Three major cadinenes were isolated from *Eupatorium trapezotsum* whose absolute stereochemistry at all relevant chiral centres was the same as that of artemisinin. These cadinenes therefore offer a great promise for their elaboration to artemisinin analogues.

Under the work done on low temperature carbonization of N.E. coals, one 50 kg/batch pilot plant unit and 2 kg/batch bench scale unit of low temperature carbonizer were installed. A 10 litre/batch tar distillation unit was also installed. A gas-chromatograph was commissioned for tar work during the period. Pilot plant trial runs between 500 and 800°C were made and resultant coke tested for cement making.

Sixty papers were published and one patent was filed during the year. □

### **Shri D.K. Mukherjee appointed Acting Director of CFRI**

Shri Dilip K. Mukherjee, Scientist F, Central Fuel Research Institute (CFRI), Dhanbad, has been appointed Acting Director of the institute with effect from 15 July 1991. He succeeds Dr R. Haque, who is now a Director level Scientist at CFRI.

An M.Sc. Tech. in Applied Chemistry (1956) from the Calcutta University, Shri Mukherjee joined CFRI in 1959 and took up the pilot plant studies on gasification of coal. Till 1975, he was associated with many process designs and economic studies on fertilizers from coke oven gas, petrochemicals from naphtha, coal gasification and gas distribution, oil from coal, etc. His primary concern over the later years has been

on the conversion of coal by hydrogenation, coal chemistry and product development particularly industrial carbon products. Some of his recent studies relate to environmental pollution control for coal-based industries with the current interest being in the bioprocessing of coal.

During 1963-65, Shri Mukherjee worked on the synthesis of Polymethylene with Prof. Dr H. Pichler, University of Karlsruhe, Germany.



Shri Mukherjee has received international acclaim for his R&D achievements in the area of coal hydrogenation, particularly the improvement on the method for application of iron catalyst, role of iron and sulphur in the catalytic system, and the mechanistic studies on the reaction and the catalytic effect of mineral matter on coal hydrogenation. Some of his recent contributions include upgrading of non-coking coal to coking/blendable type by incipient hydrogenation of coal, improvement of graphitization properties of coke, development of low-ash carbon from demineralized coal, chemical comminution of coal and its integration with selective agglomeration without taking resort to severe mechanical means.

He has to his credit 67 research and technical papers besides several reports, patents and book sections □

### **Shri Dilip Kumar takes over as Joint Secretary (Adm), CSIR**

Shri Dilip Kumar, IAS, has taken over as Joint Secretary, (Adm), CSIR, with effect from 25 July 1991. In addition, he has been given concurrent charge of the post of Joint Secretary (Adm), DSIR.



Born on 11 December 1947, Shri Dilip Kumar holds an M.Sc. degree in Physics from the University of Allahabad. He joined the Indian Administrative Service in 1972 in the U.P. Cadre, and has served the State Government in various capacities. Also, he has attended a number of training courses including the one at IMF Institute, Washington, during 1984.

Prior to joining CSIR, his assignment with the state Government was that of Secretary, Revenue, Relief & Rehabilitation and Secretary & Commissioner, Muslim Waqfs. □

### **Honours & Awards**

**Dr L.V. Venkataraman  
of CFTRI awarded  
Prof. J.V. Bhat-Eureka  
Forbes Award**

Dr L.V. Venkataraman, Area Coordinator, Autotrophic Cell Culture, Central Food Technological Research Institute (CFTRI), Mysore,

has been conferred, along with Dr S.K. Apte of the Bhabha Atomic Research Centre, Bombay, the prestigious Prof. J.V.Bhat - Eureka Forbes Award for the year 1990, for excellence in research in Microbiology in India conducted during 1986-1990. Dr Venkataraman has won this award in recognition of his outstanding work done at CFTRI, Mysore, towards developing a totally indigenous technology for commercial production of blue-green alga *spirulina*. He has been responsible for promoting *spirulina* application in India and several other countries by providing information, techniques and stock cultures. The award, carrying a cash prize and a scroll with a citation, was presented to him by Shri A.K. Mafatia, Managing Director, Eureka Forbes Ltd, on 29 June 1991.

Dr Venkataraman is a recipient of several other prestigious awards, such as Hari Om Trust Award in 1982 and 1984, Prof. Bhardwaj Memorial Award in 1988, Prof. Vyas Memorial Award and Fellow of Association of Food Scientists and Technologists, India, in 1990. □

#### PATENTS FILED

1171/DEL/90: An automatic guarded hot plate equipment for the measurement of thermal conductivity of building and insulating materials, K.N. Agarwal and V.V. Verma — Central Building Research Institute, Roorkee.

1172/DEL/90: An improved process for the preparation of 3,5-Xylenol, K.V. Ramanamurty, G.S. Salvapati and M.J. Rao — Indian Institute of Chemical Technology, Hyderabad.

1173/DEL/90: An improved process for the production of high purity ferric oxide from iron powder, C.S. Sivaramakrishnan, M.

Bodas and S. Banerjee — National Metallurgical Laboratory, Jamshedpur.

1174/DEL/90: An improved fluidized bed combustor for the combustion of coals, R.C. Borah, B.R. Mazumdar and M.M. Bora — Regional Research Laboratory, Jorhat.

1175/DEL/90: An improved process for the preparation of micro-crystalline waxes, J.S. Bahl, H. Singh, U.C. Gupta and D. Tondon — Indian Institute of Petroleum, Dehra Dun.

1176/DEL/90: An improved process for the production of polymeric insulator conductor composites of polypyrrole by chemical vapour phase deposition, D.C. Trivedi and S.K. Dhawan — Central Electrochemical Research Institute, Karaikudi.

1177/DEL/90: An improved process for the extrusion of magnesium/magnesium alloy billets, S.C. Dev, R.K. Dubey, C.S. Sivaramakrishnan — National Metallurgical Laboratory, Jamshedpur.

1178/DEL/90: A process for isolation of anticancer compound (crotopoxide) from the berries of *Piper attenuatum*, M.A. Sumathykutty and J. Madhusudana — Regional Research Laboratory, Trivandrum.

1179/DEL/90: A process for the preparation of an improved Li-promoted MgO catalyst useful for oxidative coupling of methane to ethane and ethylene, V.R. Choudhary, M.Y. Pandit and S.T. Chaudhari — National Chemical Laboratory, Pune.

1180/DEL/90: A process for the preparation of rare earth metal promoted MgO catalysts useful for oxidative conversion of methane to higher hydrocarbons, V.R. Choud-

hary, V.H. Rane, S.T. Choudhary and A.M.R. Rajput — National Chemical Laboratory, Pune.

1181/DEL/90: An improved process for the preparation of chromium copper alloy for use in electrical appliances, P. Basak, S.C. Dev and R. Dubey — National Metallurgical Laboratory, Jamshedpur.

1205/DEL/90: A process for the production of high strength high temperature high alumina (70-90%) hydraulic white calcium aluminate cement, A.K. Bose, B. Chatterjee and N.N. Mathur — National Metallurgical Laboratory, Jamshedpur.

1206/DEL/90: Improvements in or relating to the electrolytic preparation of 5-aminosalicylic acid from 5-nitrosalicylic acid using  $\text{TiO}_2/\text{Ti}$  electrode prepared by thermal method, P.N. Anantharaman, D. Vasudevan, and S. Chellamal — Central Electrochemical Research Institute, Karaikudi.

1207/DEL/90: An improved process for the production of immobilized penicillin G acylase using crosslinked spherical macroporous hydroxyethyl methacrylate terpolymers useful for the preparation of 6-amino penicillanic acid, R.V. Bahulekar, A.A. Prabhune, A.V. Pundle, J.M. Gadgil, C.K.R. Rajan, S. Ponrathnam, and H. Sivaraman — National Chemical Laboratory, Pune.

1208/DEL/90: A process for the preparation of crosslinked spherical hydroxyethyl methacrylate terpolymer beads of controlled pore size distribution for enzyme immobilization, R.V. Bahulekar, J.M. Gadgil, C. Khizhake, M.R. Rajan, A.A. Prabhune, A.V. Pundle, H. Sivaraman, S. Ponrathnam — National Chemical Laboratory, Pune.



# CSIR NEWS



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Being brought out on the occasion of commencement of CSIR Golden Jubilee Celebrations, this issue contains articles on : Changing Culture of CSIR — Dr A.P. Mitra (p 210); CSIR, Technology Missions and Rural Development — Dr Ram K. Iyengar (p 214); International Collaboration and CSIR : Highlights and Status — Shri K.N. Johry (p 216); and Role of CSIR in Scientific and Technical Manpower Development — Dr Sushil Kumar (p 221). The photographs shown here pertain to CSIR activities on National Missions: Reverse osmosis desalination plant (Drinking Water Mission), Standalone light equipped with solar panels and lead-acid accumulator (Literacy Mission), Rota disc rice bran stabilizer (Oil-Seeds Mission)

# Changing Culture of CSIR

Dr A.P. MITRA, FRS

*Former Director General, CSIR\**

For any leading organization, attitudes continuously change and its ethos and culture cannot remain stagnant. This has also been happening in the CSIR over the years. Sometimes the changes are abrupt and drastic. Drastic changes in CSIR have been introduced in the last few years following the Abid Hussain Committee. In his book *Towards a New Administrative Culture in CSIR*, Omesh Sehgal refers to 1986 as a critical time. "With the sword of the Reviewing Committee hanging over its head and the threat of disbandment glooming large, there could not have been a worst time. Or, if one were looking for innovation and changes, a better time."

## FORCING FUNCTIONS

Abid Hussain Committee Report was indeed one major forcing function for the large scale changes that have occurred in the CSIR but it was not the only one. The committee's recommendations in fact came at a time when large scale changes in the structure and organization of national science research establishments were engaging the attention of all countries, whether developing or developed. The developed countries had already recognized that economic powers stem from technological power, and technological power must be based on a solid foundation of good science. Nevertheless, there has been a feeling that 'blue sky' research outside the university system should have some boundary conditions, that research programmes planned by national science establishments should be guided, and that the final

goal would have to be its linkage with national development. It has also been clear that science and technology are often taken too narrowly and that social science, in particular the human dimensions of technological advances, must have a major place in the total scientific planning and thinking.

A third parameter that was emerging in India around this time was the introduction of Mission Mode Programmes for societal purposes. Mission Mode operation of large scientific efforts ('Big Science') has not been unknown in India. In agencies like Atomic Energy and Space, long-term action plans have been always concretized and time-targeted. Mission Mode approaches have also been used in fundamental science programmes. The best known amongst these is the International Geophysical Year conducted some 35 years ago, but missions targeted for societal problems needed a different kind of approach, a synthesis of implementation strategies and management procedures with generation of usable technologies and also a mixture of simple and complex techniques. Several such Societal (called 'Technological') Missions were introduced by the then Prime Minister, the late Shri Rajiv Gandhi. These Societal Missions included, amongst others, programmes on Drinking Water, Oil Seeds, Immunization and Adult Literacy.

CSIR was called upon, right at the beginning, to be an integral part of these Missions and provide the S&T inputs. It was even asked in some cases, as in the case of the Drinking Water Mission, to become the Coordinator of Vendors:

CMERI, for example, was asked to do so in regard to desalination plants. Implementation of programmes of this kind demanded a major change in the outlook of CSIR: ability for scientists from different laboratories to work together, abilities to understand the language of the administrators and an acceptance of the time targets.

A still another — the fourth — forcing function was the increasing demand from the industrial organizations to relate scientific activities in the national laboratories to their own production programmes both in the context of absorption and adaptation of imported technologies as well as introduction of technologies that scientific laboratories were working on. We were going through an 'acceptance' phase — a phase that occurs in all countries, including the developed ones, in the research - industry relationship. Even in the developed countries, this relationship is not always strong, as was apparent in the round table discussion by the ICSU organized in May 1990 on International Science and Its Partners. It was pointed out in this meeting that there is need for an activation of exchange of personnel at all levels between scientific organizations and the industrial systems (virtually non-existent in India) and furthermore much of the problems arise from "a lack of adaptation of industry to modern requirements for partnerships, a failure on the part of scientists to predict the industrial consequences of scientific discovery and a need for industry to recognize more fully the importance of free research in an industrial back-

\* Presently Bhatnagar Fellow, NPL, New Delhi

ground." It was repeatedly emphasized that shortcomings exist in the flow of information between the science community and its industrial partners. In India, the situation of course is infinitely worse and communication, where it exists, is between individuals and very rarely between systems.

Thus in the changes that occurred in the CSIR in the last few years there were four major forcing functions. These are:

- (i) the changing perceptions and expectations of the Government;
- (ii) the recommendations of the Abid Hussain Committee;
- (iii) introduction of Societal Missions: the expected role of CSIR in these Missions;
- (iv) increasing pressure from industrial systems.

### **Changing Perceptions and Expectations of Government**

In November 1989, there took place a meeting of Heads of major scientific agencies of the world in Australia to consider the changing role of the R&D agencies in national development. This was perhaps the first meeting of its kind. The organizations involved were some of the largest in the world: CNRS in France, NRC in Canada, CSIRO in Australia, DSIR in New Zealand, SERC in UK, Technical Research Centre of Finland, Advanced Institute of Science and Technology in Korea, Royal Norwegian Council for Scientific and Industrial Research, Agency of Industrial Science and Technology (AIST) in Japan and CSIR of India. In all these countries the roles of these organizations have been going through drastic changes in recent years — in some cases, as in TNO, as early as in 1980, but in most others, in the last 3 or 4 years. The predominant change has been the emphasis on technology transfer,

in marketing laboratory research and in generating cash flow from outside the government system. In this sense, these approaches preceded the recent requirement on Indian CSIR to generate a fraction of its resources from outside. In this approach for partial self-sufficiency and for exploitation of research, new management structures had to be developed. Some organizations moved totally away from government structures (as DSIR in New Zealand) relying largely on contract grants, and introducing strict financial disciplines and output criteria.

At the meeting, three areas were discussed. These were:

- (i) national investment on R&D
- (ii) exploitation of research
- (iii) publicising benefits of research to the government, industry and the public.

On the national investment on R&D, a major concern was the quantum of investment on R&D and also on the relative contributions to R&D in industry by industry. The government to industry ratio of investment in India is 80:20 as against 20:80 in Japan and 28:72 in Korea.

In the priority setting, different national R&D agencies have different approaches. It was pointed out that the pre-requisites for R&D programmes are: (i) targets against which progress can be measured, (ii) time-tables and budgets with specific milestones, and (iii) undertaking by the research and industry sectors to carry the projects through and utilize the results.

On the exploitation of research, it was pointed out that many firms take time to build up a basis of trust. The Netherlands' experience was that 90% of the companies it could serve were in the small and medium sectors. This they found was vitally important for the

country's economic development. The strategy was to form associations of a large number of small companies and out of these, find a number of path finders.

It was clear in this meeting that each major R&D agency is striving to find a new pathway not only in generating resources from outside but also in evolving new organizational structures and sometimes even a new culture to allow it to link its output to the planned economic development of the country and to optimize between the short-term needs of the government and the long-term problems of research.

This, in some modified sense, was also coming up in India and was setting the direction for changes in organizations like CSIR.

### **The Abid Hussain Committee Report**

The Abid Hussain Committee set many recommendations, some of which we accepted but some we did not. Nevertheless, these required a major change in the organizational structural and attitudinal culture of the CSIR. The principal change-forcing recommendations were:

(i) the recommendation that some laboratories should go out: e.g. NIO going to the Department of Ocean Development,

(ii) CSIR should earn 1/3rd of its budget from outside within a specified time frame: the philosophy was that such an earning would be a measure of its acceptance and credibility and also of a change in work culture,

(iii) there should be decoupling of the Headquarters from normal operation of the laboratories and an autonomy in the laboratories down the line to group level scientists,

(iv) introduction of a system by which the career development of scientists is looked after and also

we distinguish between good scientists and indifferent scientists.

(v) introduction of a fixed term for Directors after which they return to science.

All these required substantial changes in our attitude. Some of the comments hurt: such as the comment "Science has perished but scientists have flourished".

The first recommendation about a number of laboratories going out of CSIR was not, in our view, a positive step. An effort of this kind some years earlier had not produced results and we felt a dismemberment of this kind can also induce further dismemberment in future. The question was whether in science and technology an umbrella system that provides inter-linkage between different disciplines and can encourage development of new areas with multidisciplinary approaches is the right way to go, even though it might mean a large structure. The decision of the Society with the then President, Shri Rajiv Gandhi, was in favour of retaining these laboratories in CSIR but with the condition that the agencies interacting with these laboratories should now be a part of the decision-making system. We did this by including representatives of relevant agencies as members of the Research Councils and of the five Technology Advisory Boards newly set up, and in some cases in the Governing Body and the Society. For example, the Secretary, Department of Biotechnology, was made a member of the Research Councils of CCMB, CIMAP, NBRI, IMT and also a Member of the Governing Body and the Society. Similarly, representatives of major industries were also made Members of the Research Councils and sometimes of the Advisory Board and the Governing Body and the Society. ONGC, for example, was represented in the Research

Councils of IIP, NGRI and RRL-Jorhat as well as in the Advisory Board, the Governing Body and the Society. Thus instead of having our laboratories out, we brought the outside world in. In this endeavour two points became very important: (i) the choice of the Research Council Members, whether from the academic community or from government and industries, and (ii) defining the roles of the Director and the Research Council. The Research Councils in their functioning were to be totally different from the Advisory functions of the earlier Research Advisory Committees, but at the same time a laboratory cannot run if the Director does not 'direct'.

The concept of generating a sizeable cashflow was surprisingly easily accepted. This was because some laboratories already had a large portion of its cash coming from outside agencies like the National Aeronautical Laboratory from the LCA programme, NIO from Department of Ocean Development, etc. There were thus examples to follow. What was difficult, however, to absorb was that this quantum of cashflow was to be taken as a part of its normal budget and not as an extra element of cash or, in other words, the grants received would have to have a sizeable component of free amount to be used for laboratory purposes at the discretion of the Director. There was also the question initially of whether going out for cash in such a large measure would not dilute the scientific programmes of the laboratories. It was clarified that the programmes must be evolved first through various steps including deliberations by the Research Council and the inputs provided by the Planning Commission and the requirements of the national development as defined from time to time and then seek for external cash for certain parts of these already devised and accepted

programmes. External grants were not to be taken merely for the purpose of increasing the cashflow. We have reached an enviable level of cashflow by now — more rapidly than we had anticipated in the beginning. However, financial management of the external cashflow with that given by the CSIR still poses problems to several laboratories. There is also the disturbing fact that a large portion of this cashflow is coming from governmental organizations: this may reduce in the future in the context of their budgetary problems. On the other hand, the newly initiated processes of selling service and knowledge can be sufficiently rewarding.

### Effects of Societal Missions

The Societal Missions brought in a major change in our work culture. Our involvement was primarily in the Drinking Water Mission. A good deal of the efforts was basically non-scientific and related to the implementation strategies and management procedures. This meant a viable and workable linkage between the Headquarters and the scientific groups of the participating laboratories, and also between the Headquarters and the Mission nodal agency. There was also the question at the same time to expedite improvements in the existing prototypes. For example take the question of desalination. We had here quite a few years of activities in the CSIR and also the involvement of BHEL, and desalination plants at demonstration level were available at a number of locations but nevertheless the costs were high and the efficiencies had to be improved and furthermore there was no capability or system in position that could deliver more than 100 desalination plants at a standardized level sufficiently quickly. This needed a changing attitude and change in operation. CSIR agreed to have

CMERI as the Coordinator of Vendors for this purpose. This was a totally unfamiliar type of activity for CSIR. However, this was done exceedingly well and to the satisfaction of the nodal agency.

We also found that such association with Societal Mission type of operations need not necessarily be routine type of operations. The question of scientific source finding, for example, needed combination of remote sensing satellite imagery with existing groundbased geoelectric and other soundings. With this combination the success rate was found to increase from around 40% to over 90%.

### **Concept of Autonomy**

What worried us right from the beginning was that autonomy should not be at the level of the Director of the national laboratory but also down the line at various levels in the laboratory. Decoupling of the Headquarters from normal functions of the laboratory were done immediately. It was not difficult to introduce these changes. Devolution of autonomy at the laboratory at various levels was more difficult. It depended upon the nature of the laboratory and its own efforts. To help matters we introduced new purchase procedures and also introduced younger or middle level people to head multi-laboratory projects. In some cases this worked very well. I will give two examples — the development of squids as part of the superconductivity programme and an Antarctic expedition in which a relatively younger scientist was made the Leader of the Expedition. Both worked very efficiently. But the culture of having as the Head of the Division the seniormost man in the Division will take a longer time to change.

### **Recognition of Young Scientists**

The value of according recognition to outstanding scientist at a rela-

tively young age cannot be underestimated. The fact that the Bhatnagar Award is given for scientists below the age of 45 and has been kept at that age in spite of repeated pressures has been a good decision. For we have noticed in the recent Get-together of the Bhatnagar Laureates that most of them had done as much of more work after the Award as before. We therefore wanted to introduce an Award for Young Scientists working in the CSIR even though there already existed a similar award system of the Indian National Science Academy. This has now been going on for several years and we notice with satisfaction that the awards have not only been well made but have been well accepted. An innovation in the Award was a provision of a totally separate research grant to the Awardee in addition to whatever is available from the laboratory in which the scientist is working. This 'baby budget' has given a freedom and a flexibility to the scientist, which I understand they value. We made the selection criteria very tough: the selection is made by the same committee that decides on the Bhatnagar Awards.

### **Performance Evaluation**

Another major change was the introduction of a performance rating. Since such a rating had to be quantitative, as an initial measure four parameters were chosen: science (as defined by the impact factor of the papers published by the laboratories), technology (as defined by the production value of the processes released by the laboratory), services (as defined by the cashflow of the laboratory) and individual brilliance. This criterion was sometimes criticized but nevertheless after a couple of years the laboratories began to intercompare among themselves from the performance rating that I produced and showed to the laboratories. Coupled with this was the intro-

duction of the "Peer Review" concept in which, preferably once a year, a review was made of the performance of the laboratory with the Members of the Research Council as well as with distinguished members from academic, industrial and government agencies. It was usually one day affair in which the morning was spent in a scientific and technological review and the afternoon in the allocation of the budget based on the morning discussions. The Peer Review in hind-sight looks like a major innovation and one needs to build upon this particular concept. For this provides a connection between the Headquarters and the laboratories without imposing a bureaucratic stranglehold.

My final comment would be what I would call "the Greying of CSIR". Here the cultural change has not been as quick as we had hoped. The unacceptably high average age seen by the Abid Husain Committee remains virtually the same even though some 500 scientific positions were given to the laboratories to fill up and also more than 200 quick higher positions were allotted. There was also some feeling amongst the senior scientists, which they expressed to me in private, that in providing rewards and opportunities for young scientists we are ignoring the older scientists. This was the indication that sometimes senior scientists operated as science managers and not as science leaders and that our expectation that senior scientists generate experts out of the young scientists was not always recognized. Apart from inducting a larger number of young scientists into the system, what is needed is to have more and more of them being put up as Project Leaders. It is not necessary that we should involve them in committees.

### Concluding Remark

The changes in the culture of CSIR in the last few years have thus been in the direction of increased

autonomy, flexibility and recognition of merit. The introduction of new assessment cum merit promotion system called MANAS has to be watched with some care.

MANAS will fail if the concept of merit is diluted in the selection process. □

## CSIR, Technology Missions and Rural Development

Dr RAM K. IYENGAR

*Additional Secretary, DSIR and Additional Director General, CSIR*

One of the most difficult challenges faced by research organizations is to make the scientific and technological effort relevant to overall socio-economic development. In order to meet this challenge, it is necessary to set goals in major socio-economic sectors, identify the science and technology components and evolve an integrated interactive systems management strategy to meet the goals.

This strategy involves the development of the necessary expertise and managerial acumen to involve a number of experts from various areas such as research and development, production, finance, marketing and policy making to identify the technological and managerial goals as well as gaps and evolve alternative approaches which could lead to their attainment. Such an integrated interactive systems management strategy can lead to faster rate of technology generation and achieve better acceptability of the technological solutions as was witnessed during the implementation of Technology/National Missions to solve some of the societal problems such as drinking water, edible oil and literacy and in the integrated programmes for application of S&T to rural development.

### TECHNOLOGY MISSIONS

Technology missions on drinking water, edible oil and literacy were introduced to bring about socio-

economic transformation in the country during the seventh plan period. The integrated systems management strategy was evolved through intensive interaction with implementation authorities, technology developers and users of technology. This approach comprised the following elements:

- Formulation of the objectives of mission programmes sharply focussing on the needs of the country.
- Identification of S&T knowledge/technologies to meet these needs.
- Identification of the gaps in the existing knowledge or technologies.
- Preparation of a technology development programme along with clearly defined goals and targets, networking of the various R&D institutions, academic organizations, industries, resource requirements, time schedule, etc.
- Coordination and monitoring of the developmental work in the laboratories with the involvement of the user industries.
- Dissemination of the technologies through seminars and workshops involving users, in-

dustries, financial institutions, etc.

It is important to emphasize that interactive and participatory approach with considerable functional autonomy to participating organizations is the essence of the strategy. The goals were set and milestones agreed upon through a process of consultations. Clear responsibility and financial support were provided to the technology developers and extension agencies. This approach involved the following management innovations:

- Many agencies were able to work together, in a matrix type organization pooling resources towards a common objective.
- A new culture of cooperation has developed among various organizations in understanding each others problems and overcoming them.

### Drinking Water Mission

The primary objective of drinking water mission is to provide drinking water sources in problem villages. Several scientific and technological inputs were provided by some of the CSIR laboratories. These are highlighted here :

**Water source location :** The specific technologies developed are: DC earth resistivity meter, refraction assessment timer, bore hole loggers as well as computerized



methods for rapid interpretation of data.

■ **Drinking water quality assessment:** The specific technologies developed include kits for chemical and bacteriological investigations, mobile water testing laboratories and electronically controlled portable incubator.

**Extension of water treatment technologies :** The specific achievements include extension of technologies for removal of excess fluoride and iron, desalination and guinea worm vector control.

**Development and extension of water conservation technologies :** The water conservation technologies extended to the field included rainwater harvesting, ferrocement storage structures. A new technology for water evaporation control has also been developed.

### **Technology Mission on Oilseeds**

The objective of the Technology Mission on Oilseeds (TMO) is to increase the availability of edible oil from conventional as well as non-conventional oilseeds. This has been achieved through following programmes:

- As mustard, rapeseed and groundnut are the major oilseeds produced in the country, it was decided to modernize the mechanical expellers which are the primary processing units. Instead of importing the modern expellers, it was decided to develop the expellers of improved design indigenously. These expellers have been successfully designed, fabricated and demonstrated to commercial agencies who have taken the licence for their manufacture.
- Rice bran is an unconventional source of oil. The major difficulty in extracting edible oil from rice

bran is the spoilage of the rice bran by an enzyme which increases the content of free fatty acid in the rice bran oil, thus making it unfit for human consumption. After detailed screening of the various processes, chemical stabilization was selected for further development and commercialization. Commercial scale trials were carried out in the rice mills of the Food Corporation of India and the rice bran oil was extracted in their attached solvent extraction unit. All the trials were monitored through carefully designed scientific experiments, especially the extent of detrimental effect which such a chemical stabilization would have on the process equipment. The results of experiments were used to determine the technical and commercial viability of this process. Simultaneously, a heat stabilization process which can be used in larger rice mills was also developed. This process has been demonstrated on commercial scale. TMO and CSIR are now working to introduce rice bran stabilization throughout India to produce half-a-million tonnes of rice bran oil based on the success of these two technology development efforts.

### **National Literacy Mission**

The Literacy Mission, identified and introduced a number of pedagogic inputs to enhance the rate of literacy amongst adults. These technology inputs consisted of:

1. Video-audio learning aids
2. Solar photovoltaic technology for illumination
3. Chargeable power packs to ensure continuous power supply to the adult literacy centres.

4. Development of durable blackboards and improved technologies for manufacture of chalks, slates, etc.
5. High efficiency electronic inverter technology
6. High performance lead acid battery technology
7. Improved design of radio-cassette players

Some R&D institutes under CSIR were assigned the following responsibilities:

- Evolve specifications and quality control of solar photovoltaic systems;
- Reduce cost of radio-cassette players through value engineering as well as improved design to suit conditions of rural areas;
- Improve designs of lead acid batteries for deeper discharge, longer life and maintenance free operation;
- Improve the technology of chalk manufacture to produce better quality and low dust chalks as well as provide training to entrepreneurs in new technology;
- Design and develop chargeable power packs to provide uninterrupted power supply for lighting and learning aids.

The above tasks were carried out successfully by the laboratories in association with manufacturers of the relevant equipment. In addition a strategy was evolved to involve voluntary and non-government agencies in installing these equipment in difficult rural areas and training the rural youth in usage and maintenance of these equipment.

## INTEGRATED SCIENCE AND TECHNOLOGY PROGRAMME FOR RURAL AREAS

India cannot make progress until scientific temper permeates to the rural masses and scientific knowledge and technologies are generated and applied for development of rural industries. The non-government organizations and the voluntary sector have direct contact at the grassroot level and are also familiar with the problems of the rural areas. A network consisting of Council of Scientific & Industrial Research (CSIR), Council for Advancement of People's Action and Rural Technology (CAPART), Khadi and Village Industries Commission (KVIC), Indian Council of Agricultural Research (ICAR), Department of Science and Technology (DST), National Bank for Agricultural and Rural Development (NABARD), has been initiated

to interact with voluntary organizations. The objectives of this network is to identify technological requirements in the rural areas and provide financial, technological and managerial inputs for improvement in quality of life and increase employment opportunities in rural areas. In order to bring awareness among rural population regarding the capabilities of S&T, a number of publications, video films, etc. have been brought out. In addition, Science and Technology Demonstration campaigns are being organized throughout India with participation of a large number of agencies involved in technology generation. Through these efforts, a greater awareness of science and technology capabilities of the national laboratories, government departments and other organizations has been

created amongst the non-governmental organizations/voluntary agencies, universities and colleges in rural areas as well as district administrators entrusted with developmental responsibilities.

## CONCLUSION

The integrated and interactive strategy based on the concept of systems management has brought about greater interaction between hitherto insulated and isolated organizations/government departments. This is a practical approach to ensure that the scientific research is integrated with the developmental process and the results of science and technology efforts are used in the socio-economic development of the country. □

## International Collaboration and CSIR — Highlights and Status

K.N. JOHRY

*Adviser, International Scientific Collaboration, CSIR*

Over a period of last few decades, the advancement of scientific knowledge has provided the basic inputs for the presently improved living standards for mankind. Scientists have become increasingly aware that application of new scientific knowledge to improve human welfare is a long and expensive process in terms of manpower and money, sometimes more expensive than acquiring the new knowledge itself.

This spectacular growth of scientific knowledge has also brought into focus the international character of science and also the need, as never before, for closer scientific cooperation among countries to save on time and resources by sharing of each others

experiences in areas of mutual interest. Such cooperation enlarges our knowledge base and allows access to the best instruments and test facilities. It automatically also helps in assessing the level of our own scientific competence. International scientific contacts were earlier confined to individuals and to basic sciences. The trend in the recent past indicates that international cooperation is being increasingly resorted to for larger projects and 'big' science.

### CSIR Bilateral S & T Programmes

On an organizational level, with a view to establishing closer S & T cooperation and also using it as a vehicle to promote its own human resource development, the Council

of Scientific & Industrial Research initiated negotiations for formal bilateral arrangements for exchange of scientists between CSIR and friendly countries abroad in the sixties'. Amongst the first group of foreign S & T agencies with which the Council entered into bilateral programmes for exchange of scientists were:

- British Council
- National Science Foundation of USA
- German Academic Exchange Service (DAAD) of FRG
- GDR Academy of Sciences
- Czechoslovak Academy of Sciences
- Polish Academy of Sciences

- State Committee for Research & Technology, Bulgaria
- National Council for Science and Technology, Romania
- ARE Academy of Scientific Research & Technology, Egypt.

These bilateral programmes, signed during the sixties, helped in exposing our scientists to developments abroad and bringing foreign scientists to our laboratories. These visits helped in establishing links between relevant research groups in the two countries and identifying problems which could be worked out together in future as collaborative projects.

After a few years of operation of these exchange programmes, a stage had come when it was felt that collaborative projects in specific areas rather than ad-hoc exchanges, may be more productive and help the labs in enhancing their capabilities. The subsequent bilateral S & T agreements and protocols signed by CSIR therefore were more specific and related to identified areas/projects. In order to cover the wide range of areas in which the CSIR labs are engaged, it was felt that in a few developed countries more than one S & T agency was required to be our partner. These areas/collaborative projects are, however, subject to periodic review and modification with additions and deletions etc. to cater to changing requirements and priorities of the research programmes of the labs.

The objective to CSIR's bilateral S & T programme are :

- (a) To advance existing CSIR technologies and project implementation.
- (b) To acquire new knowledge in R & D by promoting joint R & D in projects/ programmes which are compatible with the partner groups/institutes.

(c) In obtaining expertise from partners to enable develop new products/ processes.

(d) To train, provide fellowships and organize joint conferences/ workshops, etc.

(e) To facilitate exchange of scientists, publications and information to help in creating awareness and identification of area of cooperation.

A number of such S & T cooperation protocols have been signed since the seventies which have specified areas/projects of mutual cooperation. These are with :

- Centre National de la Recherche Scientifique (CNRS) of France
- Institut Francais Du Petrole (IFP), France
- Kerforschungsanstalt (KFA), FRG
- Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt (now DLR), FRG
- Max Planck Society (MPG), FRG
- Netherlands Applied Scientific Organisation (TNO)
- New Zealand Deptt. of Scientific & Industrial Research
- State Committee for Science & Technology (GKNT), USSR
- Imperial Cancer Research Fund of UK
- National Institutes of Health, USA
- Department of Industry, Technology & Commerce (DITAC), Australia
- State Bureau of Technical Supervision (SBTS), China
- Scientific Research Council, Iraq
- Scientific & Technology Research Council (TBTAK), Turkey
- Nigerian Building & Road Research Institute

- Royal Scientific Society, Jordan
- Sudan National Council of Research
- Thailand Institute of Scientific & Technological Research
- National Council for Science & Technology (CONCYTEC) of Peru
- National Council for Scientific Research (NCSR) of Vietnam
- Science & Technology Division of Govt. of Bangladesh
- Scientific Studies Research Centre, Syria
- National Research Council (CNR), Italy\*
- Italian Commission of Alternate & Nuclear Energy Sources (ENEA)\*
- National Natural Science Foundation of China\*
- Ministry of Aviation Industry, USSR

With 35 programmes in 27 countries, CSIR scientists have now access to and links with most of the countries who have achieved scientific excellence in their own fields. They can use the formal arrangement to exchange scientific information and literature, visits, use each others equipment and facilities and work jointly to develop new processes and products and set up joint ventures. Over these years, very productive and scientifically stimulating partnerships have been developed between research groups in CSIR labs, and groups in partner countries. Major projects which have been benefitted by bilateral programmes are: Petroleum refining (IFP-IIP), Bioactive substances from Marine organisms (including specialized training of scientists in exploratory diving (NIO/CDRI-VCL, USA), Heat pump (NCL-Sal-

\* Pending formal signatures

ford), Fire research (CBRI-UK Fire Research Station), Foundation engineering (CBRI-BRS, UK), Chemotherapy of cancer and malaria (CDRI/IICT-NIH, Walter Reed), Seminal plasmin (CCMB-Max Plank), Safety & risk analysis (TNO/CLRI/IICT), Mushroom and hops technology and fur technology (RRL, Jammu-UK), Exploration techniques for groundwater (NGRI-FRG), Rock burst in deep mines (NGRI-Univ. of Bochum, FRG), Geothermal metallogenesis & quaternary upwelling and paleoclimate in Arabian Sea (NIO-Hamburg), Beverages technology and aroma recovery (CFTRI-FRG), VLBI (NGRI-FRG), Carbon FRP rudder for DO228 (NAL-DLR, FRG), GaAs mesfets (CEERI-FRG), STM (CSIO-FRG/US), Characterization of materials (NPL-NBS, USA and FRG), Ultrasonic-Standards & new applications (CSIO/NPL-UK), etc. CSIR and TISTR have developed excellent cooperation specially in reverse osmosis desalination and membranes, ferrites and pharmaceuticals chemistry. Two reverse osmosis desalination plants were gifted by the Prime Minister of India to the Prime Minister of Thailand in 1989, and assistance is being provided in setting up a number of other reverse osmosis desalination plants in Thailand.

Bilateral programmes have also been useful in intercomparison and calibration of CSIR facilities with advanced facilities, e.g. with PTB in FRG, BIPM in France, and Wind Tunnel of NAL with those in FRG under CSIR-DLR agreement.

#### **International & Bilateral External Technical Assistance**

Bilateral and multilateral assistance, which includes supply of scientific equipment, training of CSIR scientists abroad and expert assistance in new areas, has been crucial to CSIR labs in developing

new areas of competence. The assistance received by CSIR in the sixties' in setting up new facilities at IIP (Dehra Dun) with French help, at CMERI (Durgapur) with UNESCO's help and at NAL (Bangalore) with Canadian help, enabled CSIR in its early years to enter into new areas of scientific development. In subsequent years, CSIR labs received external funding for 59 projects amounting to \$ 65 million for setting up facilities in areas of high priority. UNDP, FRG technical assistance, Norwegian & Swiss assistance in that order, were the major donors.

Some examples of new areas of research and facilities set up in CSIR labs by external assistance are: Creep testing (NML- UNDP); Turbo-machinery (NAL-UNDP); New techniques of geophysical exploration (NGRI-UNDP); VLSI technology (CEERI-UNDP); Use of alternative fuels (IIP-UNDP); Coal gasification (IICT-UNDP); Structural engineering (SERC (M)-UNDP); Tower testing (SERC-UNDP); Pyro & hydro-metallurgy (RRL (B)-FRG); Milling technology (CFTRI- Swiss); Marine

geology & coastal zone management (NIO-NORAD); Bioengineering & catalysis research (NCL-UNDP); Contraceptive research (CDRI-DANIDA) and Metrology (NPL-FRG/UNDP); Animal byproduct utilization (CLRI-UNDP), etc. For the polymetallic nodules exploitation programme, the equipment obtained by NIO under Norwegian (NORAD) assistance for R V Gaveshanl was crucial.

#### **International & Regional S & T Cooperation**

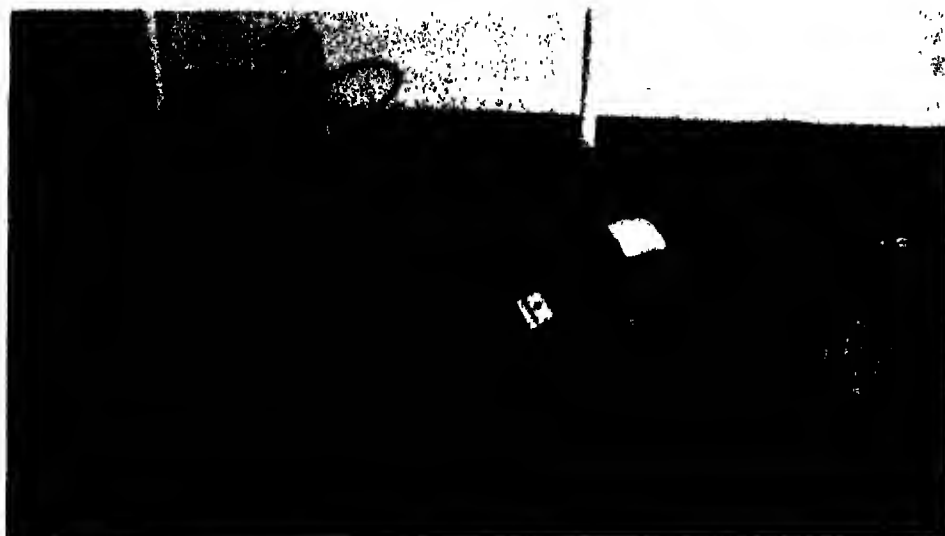
CSIR is active in regional and international programmes particularly those involving other developing countries of Asia and Commonwealth. These programmes are covered under international organizations of which CSIR is a member or represents India thereon, e.g. Commonwealth Science Council, Association of Science Cooperation in Asia and SAARC. Particular mention may be made of the Commonwealth Science Council in which CSIR has been a major contributor and partner in many of its regional programmes for Asia & Pacific region. These include a



Mobile water desalination unit being handed over to Thailand

number of projects under Rural Technology Programme of which one of the major project was the integrated management of water hyacinth, which apart from Asia-Pacific, attracted intra-regional participation and also funding from UNEP. The Asia Pacific Metrology Programme is the other major CSC programme in which

India played a leading role. The programme included training, exchanges & inter calibration including use of travelling standards — a novel concept. After having successfully run for more than a decade, the programme has been domiciled at NPL, New Delhi, as the Commonwealth-India Metrology Centre (CIMET) which was in-



Caribbean Oceanographic Resources Exploration : Collection of planktons (top right) and Boomrang-grab for collection of polymetallic nodules (top left)

augurated by Shri Ramphal, Commonwealth Secretary-General and Shri K. Narayanan, the then Minister of State for Science & Technology, in 1989. More recently, CSIR, through NIO, undertook the Caribbean Oceanographic Resource Exploration Programme (CORE) under CSC regional programmes. Natural resources of 14 Caribbean countries were surveyed by R.V. Sagarkanya and the findings submitted to CARICOM Ministers Conference. One of the major international & Commonwealth project of its type so far undertaken, the project involved direct expenditure of over \$ 1 million, shared between Government of India, Commonwealth Secretariat, CSC and CARICOM. Its follow-up is likely to improve exploitation of marine resources, including living and mineral resources, and understanding the physical changes in the ocean around these countries. New initiatives are planned by CSC in Remote Sensing and Mathematical Modelling in which CSIR is expected to again play lead roles. Both the CSC and ASCA have launched regional programmes in the area of Global Changes with India as one of the lead countries. The CSC programme is a sequel to an international symposium on Chemistry and Environment held in Australia in Sept. 89, the proceedings of which were published by the PID of CSIR.

The CSIR has special arrangement and agreements with:

(a) United Nations University for long term research and training of UNU fellows from other developing countries in the area of food conservation, biotechnology and micro-electronics, under which a number of scientists are receiving training in CSIR labs every year

(b) UNCHS and Latvian Building Research Institute (tripartite agreement) for transfer of technology developed by CSIR labs, and

Soviet institutes in building materials and technology to developing countries of the African region;

(c) Third World Academy for long term (for Ph.D.) and short term post-doctoral fellowships for scholars from developing countries in CSIR labs;

(d) COSTED for long term and short term fellowship for scientists of developing countries in areas related to IGB Programme at CSIR labs;

(e) IDRC and WAITRO (as its member) for programmes including training in CSIR and those arranged by these organizations; and

(f) the arrangement which is under discussion with the African Regional Centre for Technology for transfer of CSIR and other Indian technology to African countries.

**Training:** Training of young scientists is one of the main objectives of our bilateral programmes. Learning about newer techniques and frontline research in areas of their specialization, being carried out in partner countries, helps young scientists to not only widen their horizon but also improve their own performance on return, particularly in the frontier and thrust areas of CSIR. Apart from the CSIR's bilateral programmes, the UNDP projects, Colombo Plan and UNIDO/UNESCO programmes, CSIR's Raman Research Fellowship programme caters for young and talented scientists of CSIR to work in thrust areas in labs of repute abroad, which do not fit in under our existing bilateral/UN programmes.

For sharing its facilities and competence with other developing countries, CSIR has instituted 100 CSIR Fellowships for developing countries for Ph.D. study, which are tenable at CSIR laboratories. Apart from these, every year 80 -

100 scientists from other developing countries are provided training in CSIR labs, under sponsorship of UN specialized agencies, e.g. UNIDO, FAO and WHO, as part of UNDP-supported projects in other developing countries. The areas covered are environmental engineering, pharmaceutical sciences, leather technology, food technology, instrument development, etc.

**Consultancy:** in many areas, in which CSIR labs, have received international recognition, our scientists have been invited to act as consultants and chief technical advisers to help in implementation of UNDP-funded projects in other developing countries. On an average nearly 25 senior and middle level CSIR scientists are deputed for short and long term assignments to work on such projects every year. Areas of consultancy include metrology, instrumentation, environmental engineering, leather technology, structural and building technology, pharmaceutical sciences, glass and ceramics technology, etc. CSIR laboratories have provided consultancy for projects in other developing countries like Indonesia in Food Technology, Malaysia and Philippines in activated carbon and drugs, China in setting up of polymer and chemical research facilities and Burma in setting up nearly a dozen pilot plants based on CSIR technology, and in connection with transfer of CSIR technology to some of the developed countries, e.g. gugulipid to France, pentasil zeolyte catalysts to Holland, 'Synton' to USA, etc.

### **Participation in International Conferences**

To keep in touch with latest developments reported in scientific conferences, CSIR encourages its scientists to make presentation and attend important international conferences in areas of their



specialization within the available financial resources and with partial support of organizers and other agencies. Those conferences in which CSIR scientists do not participate, CSIR encourages other non-CSIR scientists to attend, by extending partial support for travel. Nearly 100 such non-CSIR scientists are supported every year. The scientists are required to submit detailed report for use by our scientists working in that area in the CSIR labs, and outside institutions.

Work on industrial research being mostly confined to R & D labs of private sector in Western countries, our programmes which involve university labs, or public sector labs, offer only limited access to latest technology in these countries.

Some of the constraints in achieving the best results from these programmes have been : lack of good personal contacts between CSIR and foreign scientists, lack of information base and nodal groups

in many of our laboratories to over-view and monitor international programmes, lack of sufficient funds and lack of good facilities in some of our labs for long term stay of foreign scientists.

With rapid liberalization taking place in the socialist countries and emergence of single market in Europe by 1992 and strengthening of common European S & T programmes and facilities, scientific agencies in developing countries like India face both challenges and difficulties in continuing cooperation with developed countries at the present level of support unless our own competence makes it attractive for them.

Over the last 50 years, CSIR has come a long way in promoting applied research and developing scientific infrastructure and facilities in wide ranging areas directly related to economic and technological development of the country. It has received recognition from international and leading

scientific agencies in other countries both in developed and developing countries. During this period, although CSIR has made substantial contribution towards providing indigenous technology for industry, it has also faced problems and criticism. These problems relate to accountability, funding, technology transfer and role of basic research in CSIR programmes. Other major scientific agencies abroad are also facing similar problems and criticism. To round up the Golden Jubilee Celebrations, therefore, it has been decided by CSIR to have an international conference of heads of leading scientific agencies the world over with whom CSIR has bilateral relations. The conference, scheduled for 23-25 September in 1992 will provide a unique opportunity to share their experiences in tackling these issues by other countries and help in considering alternative courses which organizations like CSIR may adopt to overcome some of these problems. □

## Role of CSIR in Scientific and Technical Manpower Development

Dr SUSHIL KUMAR

*Head, Human Resource Development Group, CSIR*

The goal of science and technology research and development (R&D) institutions of the country is to generate new scientific knowledge and to develop and adapt technologies suitable for bringing profitable products to market. Indian R&D institutions are required to achieve technological self reliance, meet global competition and fulfil requirements of development, with the funds equal to 2.6% of the country's total budget. Sufficiently large manpower of high quality scientists and engineers is

required for achieving these national objectives. CSIR complements in a major way the efforts of national education system in the area of manpower development for science and technology. It also creates opportunities for training and retraining of its own scientific staff. Besides, through its extramural programmes, CSIR supports the higher education in universities and institutes of technology which are the primary source of trained manpower. Keeping in view the future manpower

requirements, CSIR plans to redouble its efforts for enlarging the country's stock of suitably trained scientists and engineers.

### EXTRAMURAL PROGRAMMES

#### 1. Research Fellowships, Associateships and Pool Officerships

Usually the students opt for science and engineering at 10+2 stage of their education. Some of them proceed to obtain bachelor and master degrees in the different



branches of natural science and engineering. In order to improve the retention rate of the students who have already expressed interest in science, medicine and engineering and to induce them to go for Ph.D. degree or other higher qualifications, a large number of junior and senior fellowships are awarded by CSIR. Associateships are awarded to PhDs and equivalent postgraduate degree holders to encourage them to continue research in the sciences. Pool Officerships are awarded to PhDs and equivalent degree holders with 2 years of postdoctoral work experience so that they can continue to do their professional work while searching for regular positions. Fellows, Associates and Pool Officers are placed for the duration of their tenure in universities, national laboratories, government departments, public sector undertakings, industries and other institutions for higher science, engineering and technical education and research. This programme has already played significant role in the control of brain drain.

CSIR started awarding Junior and Senior Fellowships from 1958 and Associateships from 1978. Selection procedures for appointments of Fellows and Associates are very rigorous and comprehensive, so that all potential research workers are given opportunity to compete and only those possessing aptitude and high level competence for research work are selected. Indians undergoing training abroad are considered for Associateship in absentia. The programme has been designed to give outstanding researchers 3 to 13 years of employment, free of any other commitments. About 32,000 research scholars have already benefitted from this programme.

The Scientists' Pool for temporary placement of unemployed

but well qualified Indian scientists and engineers as Pool Officers was initiated in 1958. Selections to the Pool are made by the Union Public Service Commission in consultation with subjectwise Special Recruitment Boards on the basis of academic qualifications, professional experience, publication record and performance in interview whenever necessary. The tenure of Pool Officership is 3 years and they are encouraged to apply for regular positions. The scheme has benefitted about 10,000 scientists and engineers and a large majority of them have found regular jobs in the country.

The table below gives the distribution of support provided to research scholars in the 7th Five Year Plan period. Total support from 1985 to 1990 amounted to 23442 man years.

	Number of research scholars supported in					
	1985-86	86-87	87-88	88-89	89-90	90-91
Fellowships & Associateships	4216	3907	3310	3974	3989	4254
Pool Officership	643	759	849	937	858	677
Total	4859	4666	4159	4911	4847	4931

CSIR proposes to increase the Fellowships and Associateships gradually over 8th Plan period. It is planned to augment manpower in fields with shortfalls and also to have a broader geographic distribution. Pool scheme will also be continued with innovations introduced into its operation.

## 2. Support to Research Scholars for Participation in International Meetings

Often Indian research workers receive information about latest findings in their areas of activity belatedly. This hampers generation of new ideas. In order to promote greater degree of originality in the work of Indian laboratories and for the overall improvement of man-

power quality, CSIR provides travel grants for the participation of Ph.D. students and postdoctoral fellows, in important international symposia, seminars and conferences. These grants are awarded on the basis of academic and publication records of applicants. In the 7th Five Year Plan period, about 800 grants were sanctioned. In the years 1990-91, 198 research scholars were given travel grants. There is a complementary scheme for teachers and research scientists. These useful activities will be continued by CSIR in the 8th Five Year Plan period.

## 3. Visiting Associates (VAs)

The Visiting Associateships Scheme aims at fostering creative science by joint teams of scientists from universities, industries, CSIR laboratories and other government departments. It is hoped that

programme will lead to collective efforts for rapid attainment of technology adoption goals and development of integrated policies in the areas of science and technology, education and environment. The VAs are to be provided facilities in CSIR laboratories for research work, travelling expenses and accommodation for 2 visits each year. Initial tenure of a VA is 3 years. This scheme was started in 1989. In the years 1989-90 and 1990-91, there were 23 and 40 VAs, respectively. CSIR aims to strengthen this activity in the 8th Five Year Plan period.

## 4. Emeritus Scientists

Superannuated scientists represent a pool of talented and ex-

perienced teachers, guides and researchers. Many of them remain actively engaged in pursuit of science. CSIR provides financial assistance to such scientists to pursue research or write monographs or books in their respective fields of specialization, and of relevance to the programmes and activities of CSIR. In the year 1985-86, 86-87, 87-88, 88-89, 89-90 and 90-91, there were 53, 54, 55, 53, 54 and 79 Emeritus Scientists, respectively. CSIR proposes to continue this useful activity.

### 5. Distinguished Scientist Chairs

These are being instituted at R&D and academic institutions with the purpose of recognizing sustained record of excellence and creative contributions to research and/or teaching in the areas of science and engineering of interest to CSIR.

### 6. Bhatnagar Fellowships

Senior, very eminent and productive scientists and engineers are supported in R&D and academic institutions, as Bhatnagar Fellows. The Fellows are provided amenities to devote all their time to research, teaching and writing. They are expected to act as seeds for the growth of schools of young workers around them. Presently four Bhatnagar Fellows are in position.

### 7. Research Projects

CSIR distributes small research grants to non-CSIR laboratories, mainly in the universities for overall improvement of the vitality of science and engineering research in the country. The following specific objectives are met through this programme: to provide independent opportunities to brilliant research workers; to increase fellowship support for Ph.D. students who are attracted by the brilliant faculty members in the colleges and universities; to foster collaboration of postdoctoral fellows

with senior workers in the universities; for improvement of standard of equipment in universities; and to sustain both basic and applied research activities in universities. Initial tenure of projects is 3 years. The Table given below gives the number of research projects supported in 5 broad areas of science and engineering over the 7th Plan Five Year Plan period and 1990-91.

Subject area	Number of research projects supported in the year					
	1985-86	86-87	87-88	88-89	89-90	90-91
Biomedical Sciences	210	236	283	332	306	355
Chemical Sciences	274	303	317	346	285	279
Engineering Sciences	71	85	80	74	61	56
Physical & Mathematical Sciences	154	186	215	211	189	190
Information Sciences	13	23	33	32	38	30
Total:	722	833	928	995	879	910

This programme that supports small science in the country as well as attracts students for training in science and engineering will be further strengthened in the 8th Plan period and additional funds will be targetted towards the fields that face most serious shortfalls or are relatively more important for economic development.

### 8. Golden Jubilee Research Awards

CSIR is instituting these Awards from 1992-93 financial year to mark the completion of 50 years of its functioning. The Awards are intended to facilitate outstanding and talented young scientists to pursue and continue their R&D activities in their place of work in areas of science and technology of relevance to CSIR. These awards are meant for Indian scientists up to the age of 40 years within and outside CSIR who would be sanctioned project grants up to Rs 30 lakhs for 5 years.

### 9. CSIR-Units of Excellence, -Professorships, and -Adjunct and -Visiting Professorships

In order to spur intimate interaction with universities, CSIR has entered into a Memorandum of Understanding with University Grants Commission. Through this formal agreement, it will be possible to integrate the immense

training and research output potential of universities with sound infrastructure for research available in the 41 CSIR laboratories spread in different regions. CSIR has formulated schemes for effective cooperation between universities, colleges and institutions having deemed university status and itself.

Person-based and institution-based CSIR Centres of Excellence, built around individual bright scientists and group of such scientists, are proposed to be set up in science, technical and engineering universities and other institutions. It is also proposed to create some positions in selected universities in the honour of very eminent scientists.

### 10. Support for Organization of National Symposia / Seminars / Conferences

Symposia, seminars and conferences provide opportunities for scien-

tific workers coming from different laboratories to interact, leading to cross fertilization of ideas and dissemination of information. CSIR benefits scientific activity in the country by providing partial financial assistance for organization of important national and international meetings. In the years 1985-86, 86-87, 87-88, 88-89, 89-90 and 90-91, 180, 198, 200, 230, 213 and 185 meetings, respectively, have been supported by CSIR.

While continuing this activity CSIR proposes to hold a small number of Golden Jubilee symposia each year from 1991 where presentations will be made on the perspectives, especially the current work, by active investigators in sharply defined front line research areas, requiring special thrust. The proceedings will be published for the benefit of postgraduate students and research workers.

#### 11. CSIR Awards

Among the various activities for encouraging science in the country, CSIR gives honourable national awards to individual scientists working in different branches of science and engineering for their new, useful and valuable discoveries and inventions.

(a) *Shanti Swarup Bhatnagar (SSB) Prizes*: The SSB Prizes instituted in 1957 are given to scientists up to the age of 45 years, in Biological, Chemical, Earth (including Ocean, Atmosphere and Planetary), Engineering, Mathematical, Medical and Physical Sciences. SSB Prize is considered to be coveted honour for a scientist. Each award consists of prize money of Rs 50,000 and a memento. Awards are conferred by the Prime Minister. By the year 1991, 259 scientists and engineers have been honoured by SSB Prize.

(b) *CSIR Golden Jubilee Prizes*: To mark completion of 50 years of its service to nation and promote

scientific and industrial research, CSIR has started giving two Golden Jubilee Prizes from the year 1991, one each in the field of Life Sciences (including Medical Sciences) and Physical Sciences (including Chemical, and Engineering Sciences and Technology). The prize consists of a medallion and a cash amount of Rupees one lakh. Two very eminent scientists have been identified for the 1991 CSIR Golden Jubilee Prize.

#### 12. Employment Assistance

A Cell in CSIR furnishes biodata of unemployed highly trained personnel registered with it to employers who notify vacancies available with them to CSIR. The Cell displays Information Service Bulletin at the CSIR Complex for the benefit of Fellows, Associates and Pool Officers who visit the premises of its Human Resource Development Group. Queries from scientists and engineers seeking regular positions are also attended. This activity will be strengthened in the 8th Five Year Plan period.

#### 13. Interface for Non-Resident Indian (NRI) Scientists and Technologists (INRIST)

CSIR has established a new programme called INRIST from 1990. The ongoing UNDP-funded TOKTEN (Transfer of Knowledge Through Expatriate Nationals) project has been made a part of INRIST. Under the INRIST programme, CSIR is mobilizing the NRI expertise and resources to promote research and development activities in various important S&T areas in India. A Directory of NRIs giving biodata of about 2700 scientists and engineers has been published. Some products emanating from NRI expertise are already being commercialized. Under TOKTEN programme, about 320 experts have already visited over 200 institutions/organizations in India. It is planned to strengthen

these activities in the 8th Five Year Plan period.

#### 14. Science and Engineering Manpower Surveys

R&D for Science and Engineering requires inputs in the form of manpower and finances. It is, therefore, imperative to collect and analyze data about manpower for use in the process of planning. The data on Science and Technology (S&T) manpower are being collected in two complementary ways at CSIR: (a) data on annual out-turn of BEs, BTechs, MBBSs, MScs, MTechs, MDs and PhDs in different disciplines are collected from all the universities and deemed universities and (b) data on the characteristics of diploma holders, graduates and/or postgraduates in science, technical and engineering subjects are collected along with decennial census surveys. The out turn data of period up to 1989 are under compilation. Information from 1991 postgraduate degree holders and technical survey contained in about 20 lakh completed questionnaires is being tabulated for further analysis. The data will be published and made available to all interested in S&T manpower resources and requirements, using a mailing list and on request. Figure 1 gives estimates of population, percent literacy and total BSc, MSc and PhD and equivalent degree holders since 1950, derived from the available data.

#### INTRAMURAL PROGRAMMES

##### 1. Recruitment of Young Scientists into CSIR

The science and engineering postgraduate manpower in the laboratories of CSIR totals about 7000 at present. This strength will progressively decrease to about 4700 in the next 10 years as shown in the table given on p 226. A total of 2227 scientists will retire between January 1991 to December, 2001. Against the vacated positions,

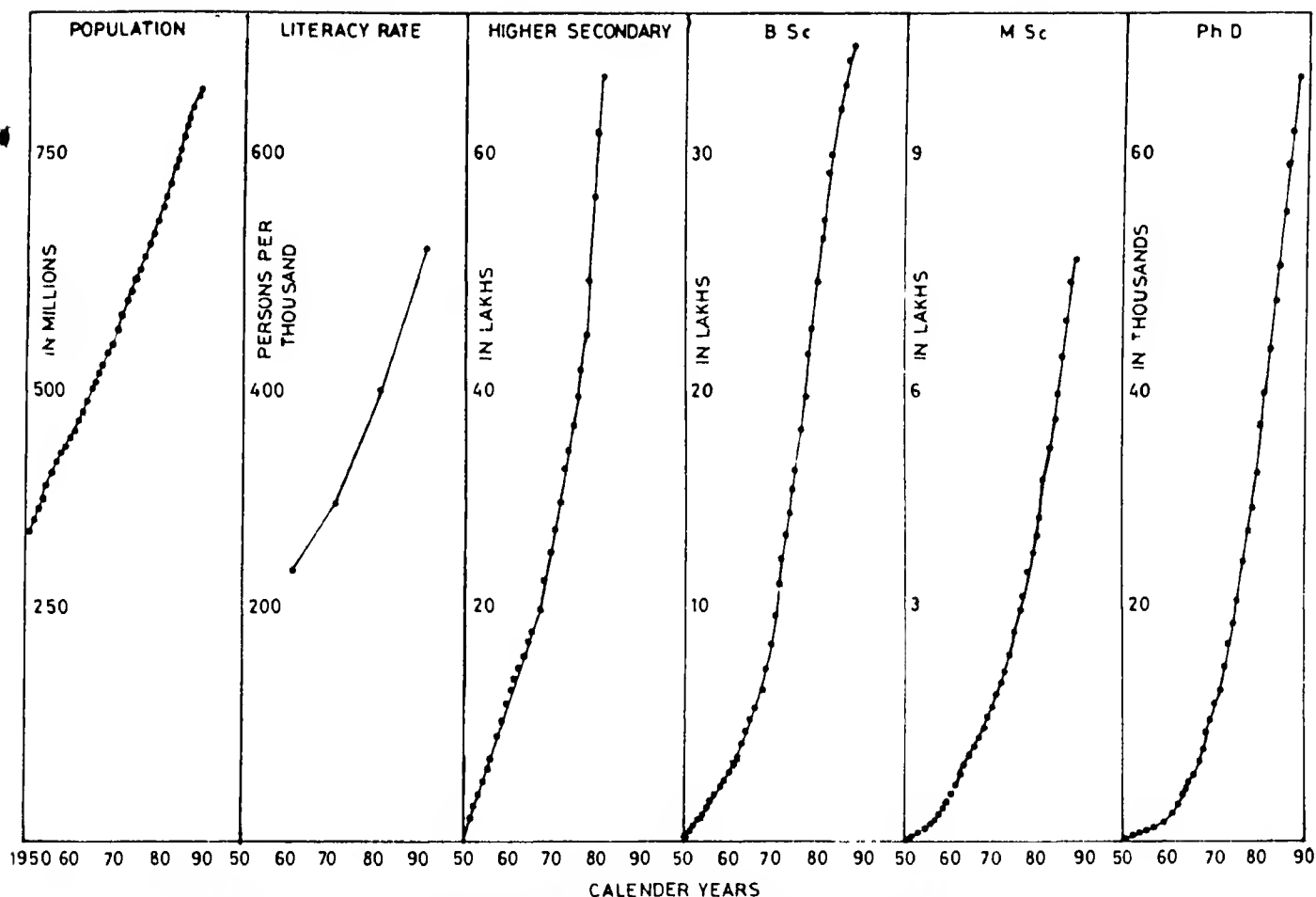


Fig.1 — 1950-1990 estimates of population, literacy percentage, and of persons holding higher secondary certificate, BSc (or equivalent), MSc (or equivalent) and Ph.D (or equivalent) degrees

CSIR would be required to recruit scientists and engineers so that it can accomplish the R&D programmes under its charter. CSIR would like to recruit on an average 200 scientists each year during the next 10 years. By making the recruitment largely at the Scientist-B level CSIR would achieve the following two objectives: (a) bring young scientists to work together with older experienced scientists; (b) give assurance of jobs to talented young scientists and engineers so that they are not lost to administration, banking and insurance sectors in India and by migration abroad.

## 2. Training Programmes

In its human resource development programme, CSIR aims at upgradation of the skills of scientists and engineers in its fold, in a

continuous manner. Training of individual scientists is arranged according to CSIR's changing requirements arising from worldwide forward movement of scientific and industrial research and redefinition of thrust area programmes. CSIR arranges training and retraining programmes to cater to the requirements of both its newly recruited and senior scientists. These activities will be strengthened in the 8th Five Year Plan. It is also proposed to start training programmes for Technicians in selected CSIR laboratories.

(a) *Training Associateship:* This Scheme is intended to support the scientists of CSIR for undergoing specialized training or conducting collaborative research in specific laboratories of the government departments, university system,

industry, or institutions such as IIT, TIFR, IARI, IISc and NII. The Associateship is for a period of six months to one year. The Training Associates will be entitled to travel expenses, monthly stipend and subsidized accommodations from the host institution, if availed at a station different from that of the parent CSIR laboratory. CSIR will pay contingency grant for each Associate to the host institute.

(b) *Training Courses on Techniques:* The various laboratories of CSIR periodically hold short term training courses on current techniques relating to research programmes of their interest. Scientists attached to the complementary CSIR laboratories participate in them in large numbers. Groups of CSIR scientists are also encouraged to take training courses relevant to their work but or-

**RATE AT WHICH THE PRESENT CSIR SCIENTISTS  
WILL BE SUPERANNUATING FROM SERVICE**

**NUMBER OF THE SCIENTISTS IN POSITION AT THE END OF THE YEAR (T)  
NUMBER OF THE SCIENTISTS RETIRING IN A PARTICULAR YEAR (R)**

END OF THE YEAR LAB NAME	1990 T	1990 R	1991 T	1991 R	1992 T	1992 R	1993 T	1993 R	1994 T	1994 R	1995 T	1995 R	1996 T	1996 R	1997 T	1997 R	1998 T	1998 R	1999 T	1999 R	2000 T	2000 R	2001 T	2001 R
CBRI	188	0	188	0	188	5	183	5	178	4	174	5	169	6	163	7	156	12	144	5	139	16	123	
CCMB	92	0	92	0	92	0	92	1	91	0	91	2	89	0	89	4	85	2	83	2	81	1	80	
CDRI	277	3	274	8	266	8	258	6	252	10	242	13	229	10	219	7	212	11	201	10	191	10	181	
CECRI	161	1	160	5	155	7	148	3	145	2	143	8	135	5	130	8	122	7	115	13	102	15	87	
CEERI	228	1	227	3	224	0	224	1	223	7	216	3	213	2	211	3	208	5	203	9	194	6	188	
CFA	37	0	37	0	37	1	36	0	36	0	36	0	36	1	35	1	34	0	34	0	34	1	33	
CFRI	314	0	314	12	302	8	294	13	281	21	260	18	242	29	213	28	185	20	165	27	138	18	120	
CFTRI	297	2	295	8	287	6	281	9	272	12	260	13	247	13	234	12	222	15	207	14	193	13	180	
CGCRI	181	2	179	9	170	5	165	5	160	7	153	8	145	10	135	15	120	8	112	7	105	9	96	
CIMAP	103	0	103	1	102	1	101	2	99	0	99	1	98	2	96	0	96	4	92	1	91	2	89	
CLRI	185	3	182	4	178	4	174	4	170	6	164	7	157	6	151	4	147	1	146	4	142	3	139	
CMERI	203	1	202	2	200	0	200	7	193	4	189	8	181	5	176	10	166	13	153	17	136	19	117	
CMRS	233	0	233	5	228	6	222	6	216	10	206	13	193	13	180	13	167	5	162	13	149	14	135	
CRR1	123	0	123	1	122	2	120	7	113	3	110	3	107	9	98	2	96	3	93	5	88	2	86	
CSIO	221	0	221	4	217	3	214	7	207	3	204	6	198	9	189	3	186	7	179	11	168	4	164	
CSIR HQ	162	0	162	2	160	4	156	4	152	9	143	10	133	7	126	10	116	11	105	18	87	14	73	
CSIR COMPLEX P'PUR	23	0	23	0	23	0	23	1	22	0	22	0	22	0	22	0	22	1	21	0	21	0	21	
CSMCRI	119	2	117	4	113	2	111	3	108	3	105	4	101	7	94	4	90	7	83	9	74	5	69	
IICB	141	0	141	2	139	2	137	5	132	0	132	6	126	2	124	6	118	5	113	5	108	5	103	
IICT	330	0	330	5	325	9	316	12	304	4	300	13	287	17	270	17	253	18	235	12	223	14	209	
IIP	185	1	184	0	184	4	180	3	177	5	172	6	166	9	157	6	151	7	144	4	140	6	134	
INT	30	0	30	0	30	0	30	0	30	0	30	0	30	0	30	0	30	0	30	0	30	0	30	
INSDOC	72	0	72	1	71	0	71	3	68	5	63	6	57	4	53	1	52	5	47	6	41	2	39	
ITRC	96	0	96	0	96	2	94	2	92	0	92	1	91	2	89	1	88	4	84	0	84	4	80	
NAL	388	11	377	5	372	6	366	5	361	9	352	6	346	13	333	15	318	14	304	15	289	13	276	
NBR1	127	0	127	6	121	0	121	6	115	2	113	9	104	8	96	8	88	6	82	5	77	5	72	
NCL	350	8	342	10	332	10	322	8	314	13	301	10	291	12	279	11	268	7	261	18	243	10	233	
NEERI	183	0	183	3	180	3	177	4	173	5	168	3	165	5	160	11	149	6	143	6	137	7	130	
NGRI	206	0	206	0	206	4	202	3	199	0	199	0	199	4	195	3	192	6	186	8	178	8	170	
NIO	236	0	236	1	235	3	232	0	232	1	231	3	228	2	226	8	218	5	213	8	205	5	200	
NISTADS	49	0	49	0	49	0	49	1	48	0	48	0	48	1	47	0	47	2	45	1	44	0	44	
NML	264	1	263	8	255	6	249	13	236	14	222	11	211	11	200	14	186	16	170	13	157	23	134	
NPL	398	25	373	14	359	9	350	12	338	12	326	11	315	14	301	13	288	12	276	12	264	11	253	
PIC	111	2	109	4	105	4	101	0	101	8	93	2	91	5	86	0	86	3	83	8	75	1	74	
RRL BHUBANESWAR	126	0	126	0	126	0	126	0	126	0	126	1	125	1	124	2	122	2	120	4	116	4	112	
RRL BHOPAL	38	0	38	0	38	2	36	0	36	1	35	0	35	1	34	0	34	0	34	0	34	1	33	
RRL JAMNUI	160	0	160	3	157	6	151	5	146	3	143	5	138	12	126	4	122	4	118	7	111	6	105	
RRL JORHAT	160	0	160	2	158	5	153	2	151	0	151	4	147	3	144	3	141	3	138	5	133	8	125	
RRL IRIVANDRUM	79	0	79	0	79	0	79	1	78	0	78	0	78	0	78	1	77	2	75	0	75	2	73	
SERC G	41	0	41	0	41	0	41	0	41	0	41	1	40	2	38	1	37	0	37	4	33	1	32	
SERC M	100	0	100	1	99	1	98	0	98	0	98	3	95	1	94	1	92	1	92	5	87	2	85	
TOTAL	7017	63	6954	133	6821	138	6687	169	6514	183	6331	223	6108	263	5845	257	5588	260	5328	311	5017	290	4727	

ganized by non-CSIR institutions, both national and international. This activity will be greatly strengthened in the 8th Five Year Plan period. Short term training courses will also be organized for technicians.

**(c) Orientation Training Programme:** In CSIR, young individuals holding postgraduate degree in science and engineering are recruited to Scientist-B positions. A distant learning programme

leading to MS(ST) degree is being organized in collaboration with Birla Institute of Technology and Science (BITS) to familiarize Scientist-Bs with the CSIR system and to facilitate their becoming productive as soon as possible. Its sessions start in July and December. The course content includes information on (i) sources of published and unpublished scientific information, (ii) basic scientific approach to solve problems, (iii) uses of instruments and tools available

for quantitative research, (iv) statistical techniques and computer usage, (v) target areas of research by CSIR laboratories and (vi) ongoing science and technology based national missions for the overall development of the country. Till March 1991, 189 scientists had registered for this programme.

**(d) Training Programmes for Senior Scientists:** A training programme of two-week duration for Scientist-Cs and -Es is organized in May and



November each year. This course includes lectures on the status of science and technology in the country, and on subjects relating to research-project management, including project planning, methodology of research, interpersonal relations, safe laboratory practices, computer usage, MIS and administrative and budgeting techniques and technology transfer programmes. Till February 1991, 108 scientists had completed this training.

(c) *Management Training*: This course of lectures for Scientist- Fs, -Gs and -Hs on principles and practices of management is being developed. It is proposed to be started during the first year of 8th Five Year Plan.

#### AWARDS

1. *CSIR Technology Awards*: To recognize, encourage and reward technology development and multidisciplinary team effort of CSIR scientists/institutes, CSIR has instituted two sets of 'Technology Awards': (i) CSIR Shield for Technology: Two shields, one each for Process and Engineering Technology is given to a CSIR group/laboratory, on the basis of excellence of its specific technological achievements. Each award consists of a 'shield' to be held in rotation for a year by the group/laboratory winning it. Two shields were awarded in 1990 and none in 1991. (ii) CSIR Technology Prize: One prize each, in the areas of Biological, Chemical, Engineering and Materials Technology is given for individual or group achievement in technology development. Each prize consists of a citation and prize money of Rs 10,000 for each member of the group, with the amount awarded to a group being limited to Rs 50,000. Three groups each have been awarded with the prize in the years 1990 and 1991.

2. *Young Scientists Awards*: These were started in 1987 to recognize brilliant scientists below 35 years of age working in CSIR laboratories. The awards are given Rs 10,000 prize money, a memento and a grant of Rs 10 lakh for 5 years to pursue research. Up to 1991, 38 young CSIR scientists and engineers have received this award.

#### CONCLUDING REMARKS

The university system is responsible for higher education in science and engineering. This system also generates new knowledge in a wide variety of areas through research. The CSIR system has good infrastructure for scientific and industrial research. It adapts and develops relevant technologies and generates new scientific knowledge. Industry uses technologies for commercial production of goods and provides services. These national activities to be internationally competitive require to be manned by high quality manpower. CSIR, therefore, uses its infrastructure and its extramural programmes for assisting academic institutions for producing highly trained human resource base for the achievement of national development objectives in the area of science and technology.

#### NCL wins Special ICMA Citations

The National Chemical Laboratory (NCL), Pune, has won two ICMA (Indian Chemical Manufacturers Association) citations for the year 1990. The first citation to the laboratory relates to the indigenous manufacture of acrylates, resulting in a large amount of foreign exchange saving, and the second to the India's export of high-tech materials to Europe, earning valuable foreign exchange.

ICMA has decided to confer the prestigious 'ICMA Acharya P.C. Ray Award for Development of Technology Indigenously' for 1990 on the Indian Petrochemicals Corporation Ltd, Vadodara, for pioneering the manufacture of acrylates for the first time in India on the basis of the innovative process development work carried out at NCL.

NCL undertook the challenging task of development of technology for the manufacture of acrylates, which are critical raw materials in the manufacture of acrylic fibre, paints, etc. NCL participated vigorously in sustained process modification efforts that were required to bring acrylates technology to a stage where it could become economically viable and competitive. Last year the production of acrylates was about Rs 400 million, which led to the saving of country's valuable foreign exchange.

ICMA has decided to confer the 'ICMA Award for Export of Chemical Products' on United Catalysts (India) Ltd, Bombay, for exporting for the first time high silica zeolite catalysts (Encillites) to the western world against keen competition from renowned companies.

NCL undertook the challenging task of synthesizing high performance zeolite catalysts, named after NCL as Encillites, having a widespread impact in various refinery and petrochemical processes. These were manufactured by United Catalysts (India) Ltd. NCL's effort opened up a new chapter on the export of high performance materials from India. This export was on quality basis and not on cost basis and that too in stiff competition with some multinational giants. □

## Syrian Delegation visits India

A four-member delegation from Scientific Studies Research Centre, Syria, visited India during 26 August-2 September 1991 under the Protocol on S&T Co-operation between CSIR and SSRC Syria signed in October 1990. The delegation was led by Dr O.F. Bizri, Director of Research, SSRC, and consisted of Dr H.A. Nour, Dr A. Nasser and Shri R. Jabra as members.

The members of delegation during their stay held discussions with Dr S.K. Joshi, Director General, Council of Scientific and Industrial Research, and visited a number of institutes in the areas of their interest, such as NCL, CEERI, CSIO, CGCRI, NPL, NISTADS, IIT-Delhi, Central Electronics Limited, NRDC, etc.

The Record Note of Discussions was signed by Shri K.N. Johry, Adviser, CSIR and Dr O.F. Bizri, on 30 August 1991.

Areas identified for cooperation, training and assistance include: Chemistry & Chemical Engineering; Biology & Bio-technology; Materials; Metrology; Electronics Engineering; Mechanical Engineering and R&D Planning and Technology Acquisition.

Possibility of technology transfer was also indicated in the areas of Electronic Devices, Glass Technology including Optical Glass and Borosilicate Glasses, Pollution Measurement and Ferrites, etc.

### TRAINING COURSES

#### Training Course on Computer Techniques for Interpretation of Resistivity Data

Interpretation of resistivity data using computers is a long standing requirement for earth scientists working in ground water exploration. A software for interpretation

of resistivity data in a user friendly environment was implemented at the National Geophysical Research Institute (NGRI), Hyderabad, on main frame computers, mini computers and on PCs and is being used for ground water exploration.

In Andhra Pradesh, the State Ground Water Department (APSGWD) and the State Irrigation Development Corporation (APSIDC) are the two major organizations which have been involved in exploration for ground water in the State for the last few decades. They have been interpreting the data using curve matching techniques which are manual and involve lot of time.

At the request of APSGWD, NGRI organized a training course on the use of the computer techniques for interpretation of resistivity data, during 15-19 July 1991. Ten officers from APSGWD, APSIDC and Andhra Pradesh Panchayat Raj Department (APPRD) attended the course. The utilities, uses and limitations of the software package for ground water exploration were demonstrated with field data. The participants were given training to get hands on experience of the software on micro-computer, personal computer, VAX and CYBER computers. A few lectures on computers and computer inversion techniques related to resistivity interpretation were also organized during the course.

Dr T. Harinarayana, Scientist, NGRI, coordinated the training course.

### PATENTS FILED

1209/DEL/90; A composition (medium) useful for shoot sprouting and multiplication for mature bamboo species, C.H. Phadke, N.N. Nagarwala, V.A. Parasharami, R.S. Nadgauda and A.F. Mascarenhas — National Chemical Laboratory, Pune.



Shri K.N. Johry and Dr O.F. Bizri exchanging the documents pertaining to the working programme between CSIR and SSRC. Dr S.K. Joshi, Director General, CSIR, is seen in the centre

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Recipients of the CSIR Young Scientist Awards (1991) with Shri P.V. Narasimha Rao, Prime Minister;  
Dr S.K. Joshi, Director General, CSIR; and Prof. E. S. Raja Gopal, Director, NPL

## IN THIS ISSUE

Prime Minister Inaugurates CSIR Golden Jubilee Celebrations	230	CSIR Young Scientist Awards: 1991	233	Application of Fuels and Lubricants in Automotive and Industrial Machines	243
Bhambhaniya Bhattacharya Prizes for Science & Technology: 1991	231	The Ethos of CSIR			
CSIR Technology Awards: 1991	232	Fifth CSIR Foundation Day Lecture by Dr A.P. Mitra	234		
CSIR Golden Jubilee Prizes	232	Polytan - A New Acrylic Syntan for Retanning Chrome Leather	241	Prof.E.S. RajaGopal appointed Director of NPL	244

## Prime Minister inaugurates CSIR Golden Jubilee Celebrations

The Council of Scientific & Industrial Research (CSIR), established in 1942, entered into the fiftieth year of its existence on 26 September 1991. It is observing the period 26 September 1991 - 25 September 1992 as the Golden Jubilee Year. The Golden Jubilee Celebrations were inaugurated by Prime Minister, Shri P.V. Narasimha Rao, who is also the President of CSIR, on its Foundation Day, at a function held in the National Physical Laboratory (NPL), New Delhi, on 26 September. On this occasion, the Prime Minister also presented the CSIR Young Scientists Awards for 1991 to six scientists, and released the following four publications:

*The CSIR Saga - A Concise History of Its Evolution (Vol. I - upto 1965), Significant Achievements - 1990, Research Output - 1990 and Body's Battles* and a video film on Sir Shanti Swarup Bhatnagar, the first Director General of CSIR.

Dr S.K. Joshi, Director General, CSIR, announced the winners of the Shanti Swarup Bhatnagar Prizes and the CSIR Technology Awards for 1991 and the CSIR Golden Jubilee Awards.

Dr G. Thyagarajan, Director, Central Leather Research Institute, Madras, who is also the Chairman of the Golden Jubilee Celebrations Committee, highlighted the year-long programme.

Dr A.P. Mitra, former Director General of CSIR and at present Bhatnagar Fellow in NPL, delivered the fiftieth CSIR Foundation Day Lecture on: The Ethos of CSIR.

A press meet was organized on the eve of CSIR Foundation Day, at the India International Centre, New Delhi, in which Dr Joshi and Dr Thyagarajan highlighted the ac-

tivities of CSIR and Golden Jubilee programme to the media people.

Inaugurating the Golden Jubilee Celebrations, Prime Minister, Shri Narasimha Rao called upon the scientists to reorient the R&D programmes to make these need-based for the benefit of larger sections of the society. Harnessing solar energy, mechanization of agriculture for meeting the needs of smaller farmers, and provision of health services to every one at affordable cost are some of the key areas which need immediate attention, the Prime Minister said. He also emphasized the need for a closer interaction between the scientists and the rural people, which constitute a major part of the society to understand their requirements.

"Come up with genuine breakthrough, to start with, in an area like solar energy. Funds will not be a problem. For such a cause, I will cut funds in other areas. This is my deal with the scientific community", Shri Rao said amidst a thunderous applause from the gathering.

Stating that 'providing basic health services to all' is a priority area, Shri Rao remarked that there are still thousands of villages where benefit of vaccination are yet to reach. Owing to financial constraints we are not able to provide the cold-chain for the vaccines which therefore deteriorate by the time they reach villages.

The traditional Indian system of medicine uses many drugs which do not become ineffective with time. In fact, in some cases, their efficacy increases with time. "Can't we make vaccines that do not need refrigeration", he asked. "After all, we can't go to Interna-

tional Monetary Fund or World Bank for loans to buy medicines," Shri Rao commented.

Another key area requiring immediate attention, Shri Rao said, was mechanization of agriculture keeping in mind the interests of the small farmers. The tractors available at present are useful only in large farms whereas most of our farmers' land holdings are small - less than two acres. "We have to design tractors which are suitable to these small farms," the Prime Minister suggested.

Our village ponds overflow during monsoon, and owing to seepage, for rest of the year there is no water. "Our scientists should develop methods to conserve water and also those strains of crops which would grow with limited amount of water", Shri Rao said. The above areas, Shri Rao said, are just a few examples. There are many more needing immediate attention. Technology solutions should not only be relevant but also affordable, he remarked.

Paying rich tributes to Shri Jawaharlal Nehru, Smt. Indira Gandhi and Shri Rajiv Gandhi for fostering the growth of science and technology in the country, Shri Rao said, "We have made great strides in science and technology. I admire the work, the hours of toil put in by our scientists".

In our country, Shri Rao said conditions vary from district to district, taluka to taluka. So the research has to be need-based at micro-level. Then only the 'Indian research' will be able to produce 'Indian breakthroughs', meeting the 'Indian challenges' and providing the 'Indian solutions'.

Referring to a remark made by the Golden Jubilee Committee

Chairman, Dr G. Thyagarajan that prisoners used to be released by the Jewish community on the occasion of Golden Jubilees, Shri Rao in a lighter vein remarked, "I am willing to release the scientists from their laboratories. Go to the villages and spread the benefits of science and technology".

Earlier, welcoming the Prime Minister and the ~~Director General~~, distinguished gathering of scientists, Dr S.K. Joshi, described the entering of CSIR in the fiftieth year as a significant milestone in the history of the Council.

Over the years, Dr Joshi said, CSIR has built up a powerful S&T infrastructure for the nation's socio-economic development. CSIR laboratories have made remarkable achievements in many areas of science and technology. A few illustrative examples of such areas are : drugs, petroleum refining, coal, catalysts, electronics, leather. About 1800 technologies have been developed and licensed.

In view of the new industrial policy, Dr Joshi remarked, the endeavour of the CSIR laboratories will be to develop technologies which are internationally competitive. For this, the Council will strive for a symbiotic relationship with the industry.

Mentioning about the Council's efforts towards S&T manpower development and its interaction with the university system, the CSIR Director General said that the Council has awarded about 30,000 fellowships. About 10% of the Council's budget is used in support of the scientific research in universities.

The Chairman of the Golden Jubilee Celebrations Committee, Dr G. Thyagarajan described the occasion as a time for stock-taking and planning for the future. To discuss the relevant issues, he said,

CSIR will be organizing the seven lead conferences:

1. Management of Change (New Delhi) (already held)
2. Science Looking Ahead (Calcutta) (already held)
3. Technology & Industry (Bangalore)
4. Science & Society (Bhopal)
5. Research - University - Industry Interface (Bombay)
6. Science Communication (Madras)
7. International S & T (New Delhi).

In addition, CSIR will be organizing a number of conferences on specific scientific areas, and co-sponsoring several international conferences.

Twelve Golden Jubilee Distinguished lectures, one in each month, will be organized, which will cover not only science but also technology, management and other issues

Documentary films will be made on Sir Shanti Swarup Bhatnagar (already released), Dr Homi

Bhabha, Sir C.V. Raman and Dr J.C. Bose. Special publications will be brought on CSIR activities, Dr Thyagarajan added.

For the school children, he said, CSIR will be bringing out popular science books, a S & T encyclopaedia and will be holding science quiz, essay competition, etc.

Prof. E.S. Raja Gopal, Director, NPL, proposed a vote of thanks.

### Awards Announced/Presented

The following awards were announced/given at the inaugural function

#### Shanti Swarup Bhatnagar Prizes for Science & Technology: 1991

The Shanti Swarup Bhatnagar Prize instituted in 1957, by the CSIR in the memory of its architect and Founder Director General, Dr Shanti Swarup Bhatnagar, is today the most coveted award for excellence in science and technology in India. The prizes, each of Rs 50,000 and a citation alongwith the memento are awarded to the Scientists below the age of 45 for their



Prime Minister, Shri P.V. Narasimha Rao inaugurating the CSIR Golden Jubilee Celebrations

notable and outstanding research, applied or fundamental, done primarily in the country during five years preceding the year of the award.

The Scientists chosen for these prizes for the year 1991 are:

#### *Biological Sciences*

Dr Virendra Nath Pandey, Biochemistry Division, Bhabha Atomic Research Centre, Bombay, and Dr Srinivas K. Saldapur, Department of Zoology, Karnatak University, Dharwad.

#### *Chemical Sciences*

Dr Biman Bagchi, Solid State and Structural Chemistry Unit, Indian Institute of Science, Bangalore, and Dr Jhillu Singh Yadav, Division of Organic Chemistry, Indian Institute of Chemical Technology, Hyderabad.

#### *Earth, Atmosphere, Ocean and Planetary Sciences*

Dr Sri Nivas, Department of Geophysics, Kurukshetra University, Kurukshetra, and Dr Sudipta Sengupta, Department of Geological Sciences, Jadavpur University, Calcutta.

#### *Engineering Sciences*

Dr Jyeshtharaj Bhalechandra Joshi, Department of Chemical Technology, University of Bombay, Bombay.

#### *Mathematical Sciences*

Dr Vikram B. Mehta, and Dr Annamalai Ramanathan, both from School of Mathematics, Tata Institute of Fundamental Research, Bombay.

#### *Medical Sciences*

Dr Shashi Wadhwa, Department of Anatomy, All India Institute of Medical Sciences, New Delhi.

#### *Physical Sciences*

Dr Deepak Dhar and Dr Deepak

Mathur, both from Tata Institute of Fundamental Research, Bombay.

#### **CSIR Technology Awards : 1991**

CSIR has instituted Technology Awards to recognize, encourage and reward technology development and multidisciplinary team efforts of CSIR scientists/institutes. The CSIR Technology Prize one each in the areas of biological, chemical, engineering and materials technology, for individual or group achievement in technology development consists of a citation and prize money of Rs 10,000 for each member of the group, with the amount awarded to a group limited to Rs 50,000. The scientists chosen for the year 1991 are:

##### *1. Prize for Biological Science & Technology*

Awarded to the group at NCL, Pune, comprising Doctors A.F. Mascarenhas, Smt. R.S. Nadgauda, S.S. Khuspe, P.R. Hendre and Smt. V.A. Parasharami for its development of New Techniques in Plant Tissue Culture.

##### *2. Prize for Chemical Technology*

Awarded to the group at Indian Institute of Chemical Technology (IICT), Hyderabad, comprising Doctors A.V. Rama Rao, M.K. Gurjar and M.N. Deshmukh for its development of Synthetic Drugs.

##### *3. Prize for Materials Technology*

Awarded to the group at CFRI, Dhanbad, comprising Dr S.N. Mukherjee, and Shri S.K. Mazumdar, Shri S.K. Das Gupta, Shri A.K. Moitra and late Dr A. Lahiri for its development of technology for Building Bricks from Flyash.

No prize has been given this year in the area of Engineering Technology. Also, no institution has been awarded the CSIR Shield for Technology.

#### **CSIR Golden Jubilee Prizes**

To mark completion of 50 years of its existence in 1992, the CSIR has instituted CSIR Golden Jubilee Prizes. This is in pursuance of its assigned objective of promotion of Scientific & Industrial Research. The idea is to lay stress on quality and encourage excellence since they would be given to most outstanding scientists in the country. The intention is to make them as the most coveted and prestigious scientific awards in the country.

There will be two prizes, one each in the area of Life Sciences including Medical Sciences, and Physical Sciences including Chemical Sciences, Engineering Sciences and Technology. The prize will consist of a medallion and a cash amount of Rupees one lakh.

The Scientists chosen for these awards for the year 1991 are; Dr G.N. Ramachandran, Formerly Professor, Indian Institute of Science, Bangalore, and Dr C.N.R. Rao, Director, Indian Institute of Science, Bangalore.

Dr Ramachandran is a pioneer in the field of biomolecular structure-function relationship. He gave the triple-helical structure of collagen which forms the basis of current understanding of connective tissue biology. He has also contributed towards definition of principles of protein conformation and general tomography. His original method of biopolymer structure mapping is now called 'Ramachandran plot'.

He has trained a large number of Scientists in X-ray crystallography methods. He has to his credit books, reviews and a large number of research papers.

Dr C.N.R. Rao is the most outstanding solid state chemist in the world today. He has contributed in a major way to the design of a variety of solids with different



structures and has studied the physical and chemical properties of substances so synthesized. He has developed several innovative methods for the synthesis of metal oxides. He was one of the first scientists to carry out detailed investigations on layered copper oxide superconductors. He has also made important contributions in the area of catalysis. Dr Rao has been responsible for bringing up a large number of very talented scientists. He is prolific and has to his credit numerous books and monographs, in addition to a very large number of research papers in highly acclaimed journals.

#### **CSIR Young Scientist Awards - 1991**

These awards are given to promote excellence in Physical Sciences (including instrumentation), Earth Sciences, Biological Sciences, Chemical Sciences and Engineering Sciences, to the CSIR scientists below the age of 35 years. Each award consists of Rs 10,000, a memento and citation.

The winners for the year 1991 received the awards at the hands of Prime Minister. The awardees are :

##### **Dr Rukhsana Chowdhury**

Dr Rukhsana Chowdhury, Scientist, Biophysics Division, Indian Institute of Chemical Biology, Calcutta : Dr Rukhsana Chowdhury's work has led to an understanding of the inhibition of replication of cholera phage - 149 in certain biotypes of *Vibrio cholerae*.

##### **Dr Amitabha Mukhopadhyay**

Dr Amitabha Mukhopadhyay, Scientist, Institute of Microbial Technology, Chandigarh: Dr Amitabha Mukhopadhyay has developed a new and general approach for selective delivery of drugs to macrophages for control of intracellular infections.

##### **Dr Ahmed Kamal**

Dr Ahmed Kamal, Scientist, Indian Institute of Chemical Technology, Hyderabad: Dr Ahmed Kamal has contributed to the use of biological reagents to bring about several chemical transformations.

##### **Dr T.K. Chakraborty**

Dr T.K. Chakraborty, Scientist, Indian Institute of Chemical Technology, Hyderabad : Dr T.K. Chakraborty has delineated novel pathways for the synthesis of several biologically important compounds.

##### **Dr Amitabha Kumar**

Dr Amitabha Kumar, Scientist, Central Glass & Ceramic Research Institute, Calcutta : Dr Amitabha Kumar has contributed to the development of concretes based on blends of portland cement with industrial and agricultural wastes.

##### **Dr Neeraj Khare**

Dr Neeraj Khare, Scientist, National Physical Laboratory, New Delhi : Dr Neeraj Khare has contributed to the development of dc and rf SQUIDS of high  $T_c$  materials such as Bi-Sr-Ca-Cu-O, and thick films of these materials.

#### **The Publications Released**

The following four publications were released by the Prime Minister:

1. *The CSIR Saga — A Concise History of Its Evolution* (Vol. 1 - up to 1965) (authors: N.R. Rajagopal, M.A. Qureshi and Baldev Singh): This volume covers the history of CSIR, documenting events of the Nehru era in chronological order. It has two sections — first dealing with the events relating to functioning of CSIR Headquarters and the second giving individual profiles of national laboratories.

In this chronological presentation of facts certain things stand out : the contribution made by Sir A. Ramaswami Mudaliar, the founder President of CSIR; the dynamism with which Sir Shanti Swarup Bhatnagar brought about the establishment of a chain of laboratories during 1950-55, and the national prestige that the association of Jawaharlal Nehru brought to CSIR and Bhatnagar, giving rise to the famous expression 'Nehru-Bhatnagar Effect'. While it was Bhatnagar who provided the environs for a scientist to work with and Thacker who stabilized and expanded them, it was Husain Zaheer who lent respectability to the designation 'Scientist'.

2. *Significant Achievements 1990* (compiled and edited by N.R. Rajagopal and S. Chandrasekaran of CSIR Hqs) : The publication highlights some of the significant contributions made by the CSIR laboratories, covering petroleum technologies, production of drugs and agrochemicals, past harvest and agrotechnologies, oceanographic surveys and geophysical investigations for location of resources, composite materials and transportation models, etc. Some notable achievements are development of a bimetallic reforming catalyst (IIP), which is in commercial use now, commercialization of technologies for production of cyanoacrylate adhesives and sodium (IICF); marketing of centchroman, a non-steroidal female contraceptive (CDRI); development of optimum process parameters for production of aluminium alloy rivets used in aircraft manufacture (NPL) and drawing-up of a detailed feasibility report on the Light Transport Aircraft (NAL). Basic research findings on superconducting materials, photochemistry, plant viruses, cellular and molecular

biology, and neurobiology, are also reported.

The publication also gives basic data regarding, cash flow, patents filed, research output, etc. in respect of CSIR laboratories.

**3. CSIR Research Output 1990 — A Bibliometric Analysis** — (compiled by T. Viswanathan, and B.K. Sen of INSDOC) : It is the fifth compilation in the series of Bibliometric Analysis of CSIR Research Output, started in 1986.

The methodology being followed for the analysis has mostly been developed by the members of the National Centre on Bibliometrics of INSDOC, the main emphasis being the impact factor of the journals, wherein the papers were placed. Data regarding the papers published were received from 37 laboratories, till 31 August 1991. The analysis has been carried out taking both impact factors and normalized impact factors into account.

In 1990, 51 papers belonging to 17 laboratories have figured in top-most journals of the world, belonging to various categories, NPL's contribution is found to be maximum and totals 13. It is followed by NAL (6 papers), IICT (5 papers), and others.

Thirty four graphs represent the research output of various laboratories for the years 1987-1990.

**4. Body's Battles** [author : Bal Phondke (pen name of Dr G.P. Phondke, Director, PID)] : The human body is continually besieged and attacked by a multitude of microbial enemies of great cunning and guile. However, nature has endowed the human body with an unique built-in defence organization that can be envied of the most modern technologically advanced nation.

This attractive and lavishly illustrated book, first in the series of popular science books superior for children being brought out by CSIR

(PID) in the Golden Jubilee Year, unfolds the dramatic story of this inner defence organization, the diversity and specificity of its armament, and the methodical way in which it maintains a round the clock vigil to meet squarely every imaginable threat to the human body and also how it wins the body's battles most of the time.

All the above four publications were designed and printed by the Publications & Information Directorate, New Delhi. □

Another popular science book, *LIFE: From Cell to Cell*, by the same author, was published earlier, as prototype of the Golden Jubilee Popular Science series.

Life on planet earth spans a multi-splendourous spectrum. At one end is the tiny bacterium, almost a non-entity, made up of a single cell. At the other end is our species, the most evolved animal, a marvel of multicellular organization. The publication, profusely illustrated, describes the exciting story of life - an eternal journey from cell to cell.

## **5th CSIR Foundation Day Lecture The Ethos of CSIR\***

Dr A.P. MITRA, FRS

I am honoured by your invitation to speak today here at NPL (my scientific home), on a day that marks the beginning of the Golden Jubilee Year of CSIR. Some 37 years ago, in 1954, I joined NPL at the invitation of the late Sir K.S. Krishnan to build up the radio science group. Amongst the audience today, I am perhaps one of the oldest in the CSIR family.

I would like to speak to you about 'the Ethos of CSIR'. One

might ask: does CSIR have or can CSIR have an ethos? Can any organization have a definite ethos in a changing world?

I believe it is possible and CSIR has. It is an old organization — but it is a living one — dynamic, self correcting, responsive with a sense of belonging. To outsiders, and even to me working within the system, it sometimes looks a non-homogeneous, incoherent, and an unmanageably large body of conflicting interests and attitudes. This apparent Brownian motion has, however, not hindered, perhaps even helped, the tremendous

element of flexibility that the system has provided over the years.

CSIR is a growing family with an awareness that growth must be controlled. From its beginnings at the Alipore Test House in Calcutta as the Board of Scientific & Industrial Research, it has now a network of 39 laboratories and over 80 field stations with a staff of about 27 thousand and a scientific strength of over 6000. This is a large body, like a large joint family. The laboratories have different characters; some are truly national, dealing with the broad spectra of science and technology, some

Please also see Dr Mitra's article on : Changing Culture of CSIR, published in CSIR News of 30 September 1991. This aspect also formed part of his lecture.

were formed in response to regional requirements and others are commodity-oriented laboratories. This reflects a responsiveness to different types of requirements. The modes of formation of the laboratories were also often different; some were grown *ab initio*, some were transferred from other systems and some came into existence by splitting of existing laboratories. Sometimes we have gone too far in this process: we have ended up splitting a laboratory into too many pieces. We shall learn some lessons from this growth pattern: one lesson is that growth has to be restrained at some stage and perhaps we have reached that stage. In fact this unrestricted growth prompted the Review Committee to recommend total elimination of our field stations. Although we should not go that far, the system must be given some boundary conditions. We could, for example, think of temporary multilaboratory centres, when a new initiative is to be taken. Indeed such an example is the Centre for Mathematical Modelling and Computer Simulation (C-MMACS) set up recently at Bangalore. And when such interlaboratory centres are set up, we should give them working autonomy. The large family system would work only under a Federation-concept with working autonomy for individual members.

#### *Response to Changing Perceptions*

CSIR can pride itself that it has responded to new areas as these emerged in the international scene. Two important examples are: Oceanography and Modern Biology. The International Indian Ocean Expedition saw the emergence of the National Institute of Oceanography. In the last one or two decades there has been an emergence of a multitude of CSIR laboratories involved with different aspects of modern biology. The in-

itiation of C-MMACS in Bangalore is also a response to the recognition that mathematical modelling and computer simulation play a pivotal role in all areas of science and technology including the biological sciences in which inputs of mathematical systems were earlier restricted to preliminary aspects of statistics.

#### *A Tradition of Distinction*

CSIR has a tradition of a sustained level of distinctions and a stream of major achievements — the distinction of having a galaxy of worldclass experts and of an ambience of easy informality. It has several firsts. NPL played crucial role in the introduction of the metric system of Weights and Measures in 1956 through the Weights & Measures Act of 1956 jointly with the Bureau of Indian Standards (then Indian Standards Institution) and the Department of Weights & Measures. The first Time & Frequency transmission started from Kalkaji in 1959 under the call sign ATA: this was later to become part of an international system. The first technological development of electronic components from indigenous materials such as soft ferrites, silver, mica capacitors and a range of carbon products including cinema arc carbons came from NPL in the fifties. These early activities were forerunners of the establishment of the Central Electronics Ltd (CEL), the first industrial unit coming out of CSIR activities.

A classic volume was Col. Chopra's 'Indigenous Drugs of India' published in 1958 — the first pioneering attempt in using the indigenous-based system within the constraints of modern medicine. Then we had the Swaraj Tractor designed and built by CMERI which later went into production by Punjab Tractors Ltd, Chandigarh. A major milestone was crossed when Punjab Tractors Ltd,

delivered its 100,000th tractor recently.

'AMUL' came out of CFTRI. The Banthra Project started by the late Prof. Kaul and nurtured by the NBRI scientists transformed the usar soil into productive biomass. R.V. Gaveshani commissioned on 3 December 1975 was an Indian-built first multidisciplinary oceanographic research vessel; it has provided some of the most valuable oceanographic data in this country for almost 25 years. This old research ship has now been reconditioned and is back for scientific work, hopefully for another two decades. The Antarctic Expeditions which have fired the imagination of scientists and the public at large have been primarily the responsibility of NIO. The first successful expedition in 1981 within a record time of three months is a landmark in Indian oceanography. In this, the role of CSIR which acted as the nodal agency has been recognized. Amongst the first, I would like to include also the discovery and subsequent efforts of metallurgical processing of polymetallic nodules, first collected from the sea bed in January 1981. We have had one of the most successful examples of technology transfer in the area of agrochemicals. More recently, there have been several firsts in drug development. Both the chemical and the biological laboratories have contributed significantly in this area. The introduction of Centchroman, the oral contraceptive, is a recent significant achievement. So has been the development of Zeolite catalysts by NCL. The bamboo flowering activity of NCL has attracted worldwide attention. In superconductivity the combined efforts of several CSIR laboratories have kept India in the frontline. These are only a few examples — to show that excellence was always nurtured and appreciated.

Testing of a 440 kV  
switchyard structure in  
Madras by SERC,  
Madras



Then there have been attempts to build major facilities: an ethos of thinking big. The wind tunnels built at the National Aeronautical Laboratory, the tower testing facility in Madras by SERC, Madras, the MST Radar that has recently been commissioned near Tirupati on a ST mode and the launching of the SROSS-C Satellite, expected in early 1992 with NPL payloads, are examples of large tasks courageously undertaken and successfully accomplished by CSIR.

In this tradition of distinction one should also mention the longstanding role of CSIR in international linkage — both in collaborative programmes with similar bodies elsewhere through agreements and in taking a pioneering role in large international programmes. The Interna-

tional Geophysical Year (IGY) which was perhaps the first organized entry of Indian science into international arena was directed by the NPL. IGY was the beginning of space age. It also changed almost entirely our concept of the earth-atmosphere system. CSIR's contribution to this changing concept was large. The Thumba Rocket Range and the Hyderabad Balloon Facility were established as a result of these activities and Indian space research began in right earnest.

So was the role of the CSIR laboratories in the SITE Programme that was taken up by India in the mid-70s. CSIR led the second aspect of the SITE Programme which involved the use of satellite radio beacons.

Another such programme is the recently concluded IMAP — the Indian Middle Atmosphere

Programme starting on 1 January 1982 and terminating on 31 March 1989. In this the thrust was on a relatively narrow part of the atmosphere from the ground to 90 km. It involved participation of some 200 scientists and 20 organizations. Facilities generated during this programme and data obtained provide now the base for global change studies and the International Geosphere-Biosphere Programme - IGBP. A by-product was the decision to set up the MST Radar mentioned earlier.

This tradition of distinction can also be gauged by looking at the people CSIR has generated. It produced a number of highly distinguished scientists of world class status and continues to do so.

#### *The Future Perspectives*

What should be our directions in future? In this I would like to draw upon the recommendations and deliberations of two major get-togethers:

- (i) International Science and its Partners: the lessons from ICSU's Visegrad meeting.
- (ii) Abdus Salam's Blue Print for science development in the South.

The first defined three kinds of partners: Inter-governmental organisations (IGO's), Government and Industry. It set up three panels to cover these three areas, the first chaired by Prof. Mayor, Director General of Unesco, the second by Dr H. Leussink, former Minister of Education and Science of Germany and the third by Dr M. Lavalou, President of the Technological University of Compiègne of France. The deliberations are important since these show the way by which CSIR may also forge its link with its partners. The partners are similar.

Before outlining the major recommendations, I would like to quote a few of the comments made



Model of the SROSS-C satellite to be launched by ASLV. It will carry NPL and ISAC payloads

during this meeting by some of the distinguished people:

(i) "Although most scientific advances could be traced back to a single scientist, it is not the best way to make an impact on society and scientists needed to respond to outside concerns". (We would consider this vis-a-vis the 'Gharana' approach prevalent here).

(ii) "The increasing importance

of science and technology driven by economic aspects whether in developed or developing countries and global environment deterioration" has to be noted. (Note the words "driven by economic aspects").

(iii) "The role of social sciences in global change and environmental questions: 80% of environmental

had as their source human activity and 100% of the solutions to these phenomena had to do with the actions of people". (Hence the need to involve people in such programmes).

(iv) "How difficult it is in countries undergoing economic crisis and/or rapid political changes for lasting links to be established between scientific communities and members of Government". (India, fortunately, is an exception).

(v) "With inter-governmental organizations, one should identify a number of major issues which represent urgent problems the solution of which requires partnerships based on concrete well-defined scientific projects between the scientific community and the inter-governmental organizations. These include environmental protection, food systems, energy supply, education and training, human health and safety, reduction of natural hazards, population and employment, development and resolution of social conflict". (CSIR may have to involve social scientists in planning its activities in these areas).

(vi) "There is a natural need in all societies for a closed tie between science (not only the natural sciences but human and social sciences) and governments".

(vii) "On Industry, three parameters were identified: matter, energy and information."

(viii) "In relationship with industries there is always an 'acceptance' phase. This must be tidied over."



Trisonic wind tunnel (1.2 m) established in 1960s still continues to faithfully serve the Indian Aerospace Community (NAL, HAL, ISRO, DRDO)

The major conclusions and recommendations that we might use as guidelines in CSIR include the following:

- (i) The need for sound reliable scientific information to be made increasingly available to governments and other partners and to be brought to their attention when necessary.
- (ii) Science community to conduct and issue independent assessments on scientific issues, of which the environment is one frequently mentioned example. This would enhance the role of scientists in governmental policy issues.
- (iii) Media are considered to be key players in the question of information and communication. Scientific community had not always drawn enough benefit from the valuable light which the media could help to shed on the needs of society in relation to science and its reactions to scientific issues."

#### *Salam's Blue Print*

Professor Abdus Salam has given a 5-point blue print for development of science and technology in the South. These five points need to be noted by CSIR. These are:

1. A substantial increase of human and financial resources for science and technology; at least tripling the number of scientists and engineers; doubling R&D expenditure to at least 1% of GNP; and a 10% cut in defence budgets in all states of the South to obtain the requisite funds.

2. Integration of science and technology programmes into national development plans, supported by an adequate financial, institutional and legal framework; raising the status of scientists in society and improving their conditions of work, with scientists assuming reciprocal responsibility towards society.

3. Exemption of scientific books and journals from copyright regulations and establishment of technological information centres; ideas on NEST (New and Emerging

Sciences and Technologies) to be borrowed from the North.

4. Emphasis to be placed on higher and secondary technological and scientific education as well as on scientific literacy. Encouragement to be given to technologists to become scientists, and scientists to become technologists.

5. Strengthening the institutional basis for science and technology by: giving first priority to the creation of 20 Centres for Science, High Technology, and Environment, with equal emphasis to be given to training and research; strengthening the organization and work of TWAS and TWNSO; and continuing to strengthen existing international centres such as the International Centre for Theoretical Physics in Trieste.

#### *The Greying of CSIR*

Since we are talking about the future of CSIR, we should be concerned with what I would call 'the greying of CSIR'. Abid Hussain Committee has already pointed out the unacceptably high average age of the scientists in the CSIR laboratories. We have in the last few years tried to bring in young scientists in different modes through the usual systems of research fellows and research associates and Pool Officers and also by introducing a quick hire system. Nevertheless the percentage of competent young scientists in the laboratories continues to be low. On top of it, there is now the increasing emphasis on austerity. I am afraid this will end up in an administrative injunction of stopping recruitment in the scientific cadres. That, in my view, will be unfortunate. While we should make all efforts to induct only people of quality and motivation, the process of entry of young scientists in our establishments would have to be continuous. A break, even a temporary one, not only



adds to the braindrain but gives the wrong signals. But, growing of young scientists into quality experts need not be limited to young recruits; we should also include people who are already in the laboratories. A significant portion of the time of the senior scientists should be spent on these young scientists. In fact a comment that I used to make was that a senior scientist should be judged not merely by the way he runs the Division or a Group or a Project but also by the number of young talents he has grown up. It is important that this role of a senior person is not underemphasized or overlooked.

Ladies and Gentlemen, I hope I have given you a sufficiently clear picture of CSIR and its ethos; of a living, continuously changing organization with excellence as a goal, but also one in which it should always try to keep itself young in spirit. □

### **Workshop on Meat and Slaughterhouse Byproducts Handling Systems**

A three-day workshop on Meat and Slaughterhouse Byproducts Handling Systems was organized by the Central Leather Research Institute (CLRI), Madras, and the Internal Development Research Centre, Ottawa, Canada, at CLRI from 15 to 17 July 1991. Dr G. Thyagarajan, Director, CLRI, was the Project Director and Shri K. Shesagiri Rao, the Project Co-ordinator, for this IDRC supported project. The main aim of the workshop was to present the major findings of the Phase I of the study and get the Peer approval for the Phase II of the programme. The workshop was attended by invited people in the fields of animal husbandry, veterinary science, meat production and handling and people involved in policy matters.

The workshop was inaugurated by Dr M.S. Swaminathan, former Director-General, International Rice Research Institute, and the keynote address was delivered by Dr P. Richard Masillamony, Vice-Chancellor, Tamil Nadu Veterinary and Animal Science University, Madras. On this occasion, IDRC was represented by Dr C. Devendra, a world renowned scientist on Animal Production Systems and CSIR by Shri K.N. Johry, Head, International Scientific Collaboration.

### **Major Findings of the Phase I Study**

The findings of the Phase I study revealed that the present system of meat animals (goat and sheep) management, marketing and their meat production and handling involve avoidable overheads, significant losses and operational constraints. These include distress sales at farmer's level due to frequent outbreak of diseases; middlemen operating in the marketing chain; transportation of live animals over long distances to urban centres, involving mortality and weight loss; indiscriminate slaughter of young and productive seed stock due to sharking supplies; hasty and inhuman slaughter taking place in the urban slaughterhouses, causing environmental pollution; partial recovery of byproducts and inflicting of flaycuts on the skins; and unhygienic handling and transportation of meat.

### **Proposals for the Phase II Study**

Based on the findings of the Phase I study, a research proposal for Phase II study was presented in the workshop as one of the alternative models to the present system of meat production and handling. The central theme of this model is the establishment of model rural slaughterhouses in the places where goats and sheep are

predominantly reared and supplying packed meat to urban centres similar on the lines of milk production and distribution system. The benefits envisaged are: (i) fair returns to the farmer, (ii) supply of hygienic meat to the urban consumer, (iii) effective recovery and processing of byproducts into value-added products and (iv) rural employment generation/opportunities.

The work programme was commended by the workshop for the approval by IDRC, Canada. There were also six special lectures. A film presentation on 'Goats and Sheep Management, Marketing and Their Meat Production and Handling' also formed a part of the workshop. □

### **Zero Resistance Microcoulometer to measure Galvanic Corrosion Current**

When two different metals/alloys are put in contact with each other in a corrosive solution, one suffers accelerated corrosion while the other suffers no corrosion, when compared to uncoupled metals/alloys. This galvanic corrosion is a very important aspect in selecting materials of construction for an equipment or structure.

The galvanic corrosion damage is best assessed by the magnitude of the current which flows across the galvanic couple in the external circuit. Larger the galvanic current, greater is the galvanic corrosion. Commonly used current measuring devices introduce a finite resistance in the circuit so that the measured value is always lower than the true value. Hitherto developed instrumentation for the purpose includes a potentiostat or an operational amplifier which contributes zero resistance and a recorder to follow the current (I) flow in the time (t). The average gal-

vanic current density is obtained by graphical integration.

The instrument developed now can be used in place of the potentiostat and the recorder. The charge flowing across the couple (It) at any instant 't' can be obtained, from which the average galvanic current can be easily assessed.

It consists of a chopper-stabilized, low noise, low bias current amplifier as current-voltage converter. The voltage is converted into a frequency output which is counted.

Specification of the instrument are:

Input Impedance:	1 T ohm
Input bias:	5pA
Range:	0.1 $\mu$ c to 1.0 mc auto 1.0 $\mu$ c to 10 mc (auto)
Counter:	8 digit LED display
Data:	Hold/Reset facility

A study of Mg/Zn couple with the instrument in comparison with the potentiostatic technique has demonstrated the applicability of the instrument.

The instrument is simple in operation. The potentiostat-recorder set up costs around Rs 50,000 whereas the manufacturing cost of the developed instrument works out to around Rs 7,000 only per unit. In addition, it makes use of indigenously available components. □

### **Semi Automatic Powerloom for Coir Mattings**

Coir mattings are woven on handloom or on machine loom, the operation of which is similar to that of weaving cotton cloth and other textiles. Bureau of Indian Standards has laid down specifications for production details of coir mat-

tings and quality of yarns. For production of quality mattings in a variety of patterns, the four-treadle, also called four-shaft, is used for weaving. Two-treadle weaving is for simple design and both sides of the matting present the same appearance.

Spindles of coir yarn are housed in a creel stand. The coirs are drawn through combing plate in specific sequencewise and form the warp sheet. Each weft thread is passed alternatively over and under successive weft thread and adjacent ends weave exactly opposite to each other. Patterns of the matting are formed by the weft and not by the warp.

MERADO, Madras, has designed and standardized a semi-automatic loom machine based on the machine developed by the Central Coir Research Institute, Kalavoor, Kerala. Two-treadle coir matting of one metre width can be woven on this loom with 32 weft per foot. This machine can also be modified for 4-shaft operation for weaving the coir mattings of different patterns.

The loom is driven by a brake motor through reduction unit. Brake motor operation is controlled for every revolution of crank or load by a limit switch. Each revolution of crank through a suitable transmission makes an eccentric disc to rotate and the treadle frames move up and down. This forms the shed opening for weft with shuttle to pass. Intermittent operation of brake motor also controls the release of the warp sheet as the weaving progresses. Closeness of the weaving is taken care of by slay arm with reed frame. Woven sheet is pulled by a spiked roller which is connected with line shaft through a worm and wheel. Woven matting is rolled in the cloth roller with the help of another spiked roller.

This machine has been fabricated by using standard channels and angles to ensure sufficient rigidity. For mounting all important assemblies, self aligning ball bearings housed in plumber blocks are provided ensuring smooth operation. The machine (costing Rs 0.125 million) will find widespread use in coir industries because of higher production and ease of operation as compared to hand looms.

#### **Specifications of the machine:**

Width of matting:	1 m
Production rate:	5 m/h (approx)
No. of weft:	32
Size of the machine:	2.75 x 9 m
Power:	2.25 kW/3 phase.

□

### **Genetic Engineering Technique for Biological Treatment of toxic wastes**

Scientists at the Madras Unit of the National Environmental Engineering Research Institute (NEERI), have been making studies to develop specialized mutant and genetically engineered bacteria through in vivo technique, for bioaugmentation of industrial waste water and for spillsite bioremediation. They isolated several bacterial strains from industrial effluents and evaluated them for their degradative potential. Among the isolates, *Pseudomonas pseudoalcaligenes* has been found to utilize a wide array of toxic chemicals as sole carbon source. The bacterium harbours a plasmid, an extra chromosomal DNA which codes the enzymes for detoxification of the toxic pollutants.

Immobilization of bacteria at solid-liquid interface plays an important role in detoxification of ef-

fluent. Cells immobilized on calcium alginate efficiently have been found to degrade the aromatic substances, nitrobenzene and benzoate provided as mixed substrate. They cause nitrate release indicating oxidative metabolism of nitro aromatics.

Studies on gene transfer and trans conjugant formation have been conducted in sterile and non-sterile industrial effluents. Results indicate the efficient transfer of the dissimilatory trait to other strains thereby increasing the gene pool, giving a high gene dosage effect. Effect of total suspended solids (TSS), aeration and temperature on transconjugant formation has also been investigated. TSS at 530 mg per litre causes maximum transconjugant formation. The numbers decrease when TSS values either increased or decreased. Admittedly, TSS provides the surface area for cell to cell contact necessary for conjugation. It has been found that a temperature of 30°C supports maximum transconjugant formation with a long cfu of 11.83. At 40°C, the viability of the bacteria is affected. Also, aeration through agitation profoundly influences transconjugant formation. Presumably, it causes shearing of the pill through which the genes are transferred.

Further studies on *P. pseudoaeruginosa* are being carried out to enhance its capability. □

### **Polytan — A New Acrylic Syntan for Retanning Chrome Leather**

Scientists from the Polymer Division, Central Leather Research Institute, Madras, have developed a high performance acrylic syntan called Polytan. This product has been synthesized by graft copolymerization of acrylic ester and acid monomers onto a renew-

able resource materials. The product is a water soluble polymer with 25% solid content. This product with hydrophobic and hydrophilic functionality can impart fullness, belly-belly uniformity to leather and the hydrophilic groups such as carboxyl or sulfonic acid groups could form coordinate complexes with collagen during leather processing. This product on interaction with chrome aids in the better chrome exhaustion. The total demand of this type of product has been projected about 800 tonnes/annum.

The technology has been demonstrated and released to M/s Chem Crown India Limited, Madras, for commercialization, and the firm has gone into production. The process technology has been successfully demonstrated to M/s Chem Crown India, Madras, by CLRI scientists. The company has since then started producing Polytan on commercial level also.

### **Fracture Behaviour of Crust and Finished Leather**

The Central Leather Research Institute (CLRI), Madras, has investigated the fracture behaviour of connective tissue fibres and casein films grafted with acrylate monomers. The mechanical behaviour of keratin and collagen fibres reveals that the fracture pattern is sensitive to the rate at which the strain is applied. When the strain rate is high, the skin fibres seem to melt due to internal friction and undergo catastrophic fracture. The skin fibres also seem to undergo plastic set behaviour when subjected to repeated stress-strain cycles. These observations are relevant to the understanding of the failure of leather and leather products in use and during the manufacture of leather products. Further, the studies on casein films grafted with acrylonitrile and N-

butylmethacrylate also indicate the possible directions in which a large finished film of adequate resistance to wet rub can be obtained. This is particularly significant in light of the casein finished leathers made currently, showing poor wet rub stability. The thermomechanical stability of casein films grafted with acrylic monomers has been established and the fracture pattern of such films under two dimensional stress offers new knowledge. The fracture mechanics of crust and finished leather has been understood at a fundamental level. This knowledge is also useful in the development of non-destructive testing methods.

### **CFTRI processes released**

The Central Food Technological Research Institute (CFTRI), Mysore, has recently released the following processes to industry:

#### **Beneficiation of sunflower seeds**

The process for beneficiation of sunflower seeds has been released to Kamani Oil Industries, Bombay. The products obtained after beneficiation are sunflower seed kernels and hulls. The seed kernels are used in the preparation of snacks, chikkis, confectionery items, etc. Hulls are used for the production of wax and as fuel.

The process consists of cleaning, grading, decortication, size classification and air separation, to get the kernels. About 62% kernel yield is obtained through this process. The cost of project is Rs 0.85 million for a plant of one tonne/hour capacity.

#### **Spice oleoresins**

The process for spice oleoresins has been released to Bharath Agro Processors Ltd, Muvathupuzha, Kerala. Oleoresins are extracted from spices containing all the active flavouring principles. The product is recovered through distil-

lation and solvent extraction techniques. After removing the solvent, the hot oleoresin is filled in tins to prevent any crystallization.

The process is essentially same for all types of spices such as pepper, ginger, chillies and turmeric.

The cost of the project is Rs 6 million for a plant of one tonne of raw material/day capacity.

### **Malted beverages**

The process for malted beverages has been released to Himani Ltd, Calcutta. Malted food beverage is produced utilizing the vegetable proteins manufactured indigenously, either protein isolate or protein-rich flour of edible quality is used as a base. They are admixed in suitable proportions with fine flours of malted millets, sugars, cocoa, etc. The water content is adjusted to get the desired finished product and the dough is dried either in a vacuum shelf drier or in a spray drier to get the desired final product.

The cost of the project is Rs 2 million for a plant of 500 kg product/day capacity.

### **Simple pulse dehusk machine**

The process for simple pulse dehusk machine has been released to Arbor Engg.(P) Ltd, Pune. This is a simple machine which can be operated either by hand or using a motor to dehusk and split pulses. The machine can process about 40-70 kg of pulses per hour. It works on the simple principle of abrasion. The cost of the machine is about Rs 5,000.

### **Pickles and Chutneys**

The process for preparing pickles and chutneys has been released to Woodland's Hotel(P) Ltd, Bangalore.

Pickling is one of the methods of preservation of fruits like lime, lemon, green mangoes and

vegetables like green chillies, cucumber, cabbage, carrot, etc. Pickling is done in two stages, viz.(a) Curing or fermentation with dry salting or fermentation in brine or salting without fermentation; and (b) finishing and packing.

Fruits such as apples, peaches, plums, apricots and mangoes and vegetables like turnips, cauliflowers, carrot etc. are the basic raw materials for chutneys. Onion, garlic, spices, herbs, etc. are added for flavour. Vinegar, common salt and sugar are also used to make them more palatable.

### **Desiccated Coconut**

The process for desiccated coconut has been released to Lakshadweep Development Corporation Ltd., Calicut.

The process consists of shelling, paring, removal of coconut water, washing, disintegrating, drying and packing of the fully ripened coconuts. One thousand coconuts yield about 100-110 kg of desiccated coconuts.

The cost of the project is Rs 1.77 million for a plant of one tonne/day capacity (annual production value Rs 7.5 million).

### **Fruit preserves and candies preparation**

The process for fruit preserves and candies preparation has been released to Mahendrakar Food Industries, Bidari, Karnataka. The fruit preserve is made from properly matured fruits such as apple, amla, green papaya, strawberry, etc., by cooking it whole or in large pieces in a concentrated sugar syrup till it becomes tender and transparent. After softening the fruit, it is cooked in sugar syrup till the concentration of the sugar syrup reaches about 70%. This is commonly known as tummy-fruit. Preserves are used in sweetmeats, confectioneries and bakeries.

The process for making candies is the same as that employed for preparing preserves with the difference that fruit is impregnated with higher percentage (75%) of sugar syrup.

The cost of the project is Rs 1 million for a plant of 100 tonnes/yr capacity (annual production value Rs 1.8 million). □

## **CFTRI Consultancy Projects Completed**

The Central Food Technological Research Institute (CFTRI), Mysore, completed the following consultancy projects: Spice processing unit for Super Bazar, New Delhi; Desiccated coconut plant for Lakshadweep Development Corporation, Calicut and Establishment of a plant for processing Tuna fish waste into fish meal at Agatti Islands, for Lakshadweep Development Corporation, Calicut.

The demand for spices in value-added form like spice powders, curry powders, spice oils and oleoresins in the national & international markets is growing at a faster rate. Super Bazar, New Delhi, has taken up the plan to expand and mechanize their existing plan to handle 100-120 tonnes of spices per month from the present handling capacity of 30-40 tonnes/month. The plant and equipment cost would be Rs 4.2 million and the power requirements would be 150 kVA.

The Lakshadweep Development Corporation Ltd, entrusted CFTRI with the task of establishing a one tonne/day desiccated coconut plant at KADMATT Island in Lakshadweep to generate employment and utilize natural resources. The plant will powder 300 tonnes of desiccated coconut per annum at an estimated cost of

around 3.4 million and provide employment to around 35 persons.

## TRAINING COURSES

### Application of Fuels and Lubricants in Automotive and Industrial Machines

A two-week training course on 'Application of Fuels and Lubricants', was held at the Indian Institute of Petroleum (IIP), Dehra Dun, for the Hindustan Petroleum Corporation Ltd, starting from 19 August 1991. Fourteen engineers participated in the course which comprised class room lectures and practicals related to automotive fuels and lubricants, industrial lubricants and fuels.

Dr R.S. Venkataraman, Group General Manager, Engineers India Ltd, while inaugurating the course called upon the participants to give customers' feed back to refiners, who in turn, should pass it on to the designers like EIL. He also laid emphasis on the preservation of environment before it becomes an insurmountable problem.

Shri S.R. Mehta, Chief Technical Services Manager, HPCL, in his address gave the background of merger of Esso and Caltex to form HPCL. He opined that there is a greater need for R&D in today's context than it was in earlier days. And it is where the role of institutes like IIP becomes important, not only for training of personnel but also for R&D support.

Welcoming the participants, Dr T.S.R. Prasada Rao, Director, IIP, expressed his happiness that the industry was now coming forward to utilize the institute's expertise in getting their personnel trained. He assured that his institute will always be willing to provide R&D back-up as and when required by the industry.

Dr Himmat Singh, Head, Training Division, initiated the proceedings and proposed a vote of thanks. He also gave details of the course content.

The Valedictory address was given by the Chief Guest, Shri S.K. Kapoor, General Manager, HPCL, Bombay, who also presented certificates to the participants. Laying great emphasis on the conservation of fuels and lubricants, he said that efforts are on for the development of a suitable 2T oil whereby its use in two wheeler vehicles can be reduced from 2% to 1%. The need for doing so is very important in view of high foreign exchange involved in the import of such oils and ever increasing population of such vehicles. He also stressed the need for re-refining of used lubricating oils. Praising the excellent faculty and facilities available at IIP he said that HPCL will not only continue to use these for such training programmes but also utilize these for its R&D programme, and in-house training courses by inviting IIP scientists over there.

Shri K.R. Bijlani, Chief Training Manager, HPCL, also spoke on the occasion. He expressed satisfaction over the methodology and coverage of the training course and assured that the knowledge gained by the participants will be applied by them in giving better service to the consumers. □

### Training Programme for Artisans and Supervisors of Leather Tanning Industries

A training programme for artisans and supervisors under the All India Coordinated Programme (AICP) of rural artisanal leather tanning industries, was organized by the Central Leather Research Institute (CLRI), Madras, from 10 June to 24 July 1991. The programme is being implemented by the Centre for Technology and Development (CTD), New Delhi,

with the support of Department of Science & Technology (DST), New Delhi. Earlier in 1984, CTD with the active collaboration of CLRI and support from DST had set-up rural tanning industries at Mandi (Himachal Pradesh), Dehra Dun (Uttar Pradesh), etc., which are running as economically viable and self sustaining units. The basic training for technical supervisors and master artisans was provided at CLRI along with follow-up field level training and visits by CLRI scientists.

DST is now supporting CTD under AICP to set-up similar units in other states of the country. In the first phase, 10 such projects have been finalized. These projects cover apart from vegetable tanning, wet blue tanning, full chrome tanning and footwear making. The present training programme was attended by teams from seven different voluntary organizations participating in AICP, from UP, Haryana, Bihar, Orissa, Manipur, Maharashtra and Himachal Pradesh. Each team consisted of one coordinator, one supervisor and one or two master tanners. In all 21 personnel received training.

Apart from intensive training in vegetable tanning, wet blue tanning and upper leather manufacture and footwear manufacture, lectures were delivered on the various theoretical aspects of leather manufacture, newer types of finished leathers, footwear and leather goods manufacture and byproducts utilization. The valedictory function was held on 24 July, when Shri D Raghunathan, Coordinator, AICP, CTD and Shri C.J. Johnny, DST, participated in the deliberations and dwelt upon the salient features of AICP and the future development proposals. □

## **Prof. E.S. Raja Gopal appointed Director of NPL**

Prof. E.S. Raja Gopal, Department of Physics, Indian Institute of Science, Bangalore, has been appointed Director, of the National Physical Laboratory, New Delhi, with effect from 12 August 1991.

Prof. Raja Gopal (born 12 May 1936, Tamil Nadu) did his Ph.D. in 1961 from the Indian Institute of Science, Bangalore. Thereafter, he worked as CSIR Pool Officer (1964-65), Assistant Professor, IISc, Bangalore (1965-69) and Professor, IISc, Bangalore (1969-91).

Prof. Raja Gopal's field of specialization is Condensed Matter Physics: Cryogenics and instrumentation. His major research work has been precision physicochemical measurements of critical point phenomena alongwith the development of associated precision experimental techniques. His observations of deviations from the rectilinear diameter law (particle-hole asymmetry) and universality features of the resistivity and dielectric behaviour are interesting. Recently, he studied the phase transitions in amorphous disordered solids using ultrasonic, high pressure and low temperature techniques.

Prof. Raja Gopal was awarded S.S. Bhatnagar Prize for Physical Sciences in 1978 and Sir C.V. Raman Award of the Acoustical Society of India for the year 1979-80.

He is a fellow of various institutes: Indian Academy of Sciences, Institute of Physics, Acoustical Society of India, Indian Cryogenics Council, Ultrasonic Society of India and Life member of Indian Physics Association and Instruments Society of India. □

## **HONOURS & AWARDS**

### **Prof. D. Balasubramanian**

Prof. D. Balasubramanian, Director-Grade Scientist, Centre for Cellular & Molecular Biology, Hyderabad, has been awarded the Henry Fukui Award of \$ 1,500 by the National Foundation for Eye Research of USA, Rochester, MI, USA. This award is given to individuals who have made outstanding contributions to cataract research. Prof. Balasubramanian will utilize this award towards travel to the meeting of the Collaborative Cataract Research Group, to be held in Hawaii during 30 November-5 December 1991, where he has been invited to present his research work.

Prof. Balasubramanian and his group at CCMB have been pursuing research on the molecular basis of cataract formation and the loss of transparency of the eye lens—an age-related disease that afflicts over 4 million Indians every year. His group has established the sites or residues in the lens proteins which are involved in crosslinks, yielding high molecular weight aggregates. These aggregates precipitate from solution and lead to lens opacity. More recent work from his group has provided the molecular connection for the epidemiological finding that cigarette smoke, as well as firewood and similar cooking smoke, increase the risk of cataract formation. They have shown that the aromatic compounds in such smoke systematically reach the lens and generate reactive oxyradicals upon the absorption of visible light. In addition, trace metals present in the smoke generate such radicals too. These radicals damage the lens cell membranes

and proteins, leading to lens malfunction. □

## **ANNOUNCEMENTS**

### **INDO-US Workshop on Underground Space Technology**

The Central Mining Research Station Unit at the Central Building Research Institute, Roorkee, is organizing INDO-US Workshop on Underground Space Technology at CSIR Science Centre, Lodhi Estate, New Delhi, during 30 October - 2 November 1991.

The main objective of the workshop is to initiate the process of interaction between US and the Indian scientists and technologists for mutual benefit. The discussions at the workshop are expected to help in evolution of new ideas and formulation of R&D schemes which may be pursued in future.

The participants should take along with them 3 copies of the write up on the following themes : Planning and design of underground space, Construction technology, Legal matters and construction management, Projects monitoring and problems of projects in use, Construction safety and machine tunneling, Site evaluation and geotechnical studies and New trends and future developments. Slides and overhead projector would be made available for use by the participants.

Further details can be had from: Dr A.K. Dubé, Scientist-in-charge, CMRS Unit, CBRI, Roorkee 247667. □



# CSIR NEWS



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PCC poles are extensively used in transmission and distribution of electric power in rural areas and urban townships. CBRI has developed a Direct Electric Curing (DEC) technique for accelerated curing of PCC poles for their mass production. A report on the institute's R&D activities for 1990 appears on p.248.

## The Management of Change

First in the series of the conferences being organized as a part of the year-long CSIR Golden Jubilee Celebrations, the conference on 'Management of Change' was held at the India International Centre, New Delhi, on 27 September 1991. Dr S.Z. Qasim, Member, Planning Commission, inaugurated the conference; he spoke on 'Upgradation of Technology with Time'.

Dr G. Thyagarajan, Chairman, CSIR Golden Jubilee Celebrations Committee, welcomed the participants. Dr S.K. Joshi, Director General, CSIR, highlighted the role of CSIR in the development of Science and Technology. He stressed that we should learn from the developed countries as to how they adopt the change of management.

Dr A.M. Khusro, Editor, The Financial Express, delivered the keynote address on 'The Management of Change: Dimensions and Inter-relationships', in the opening session. He described the nature of changes like political change, social change, economic change and technological change and their dimensions and inter-relationship. India, he said, is a mixture of feudal and democratic societies, and it could be divided in various kinds of loyalties (horizontal as well as vertical) like caste loyalty, political loyalty, regional loyalty, etc. He stressed the loyalties which could damage the national development, should not be allowed to develop. We should develop the mutual tolerance of opposition. One should consider that the other fellow may also be right. He emphasized that certain sectors should be privatized for proper output, because public sector is always in deficit. Change has to come because we could not achieve up to the mark in 40 years.

For change, liberalization be adopted instead of revolution. We should identify the good indigenous technology and give financial support to the technology and withdraw the support after some time when it becomes self sustained. We should invite only selective technologies of relevant nature from abroad.

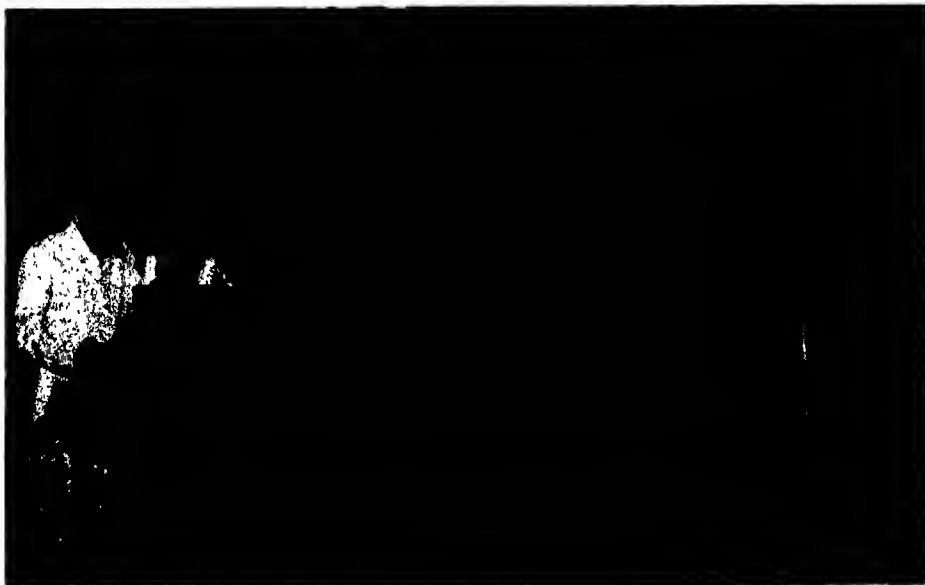
Shri K.N. Johry, Convenor, proposed a vote of thanks.

In the second session, chaired by Shri K.R. Narayanan, former Minister of State for Science & Technology, Prof. A. Rahman, former Director of NISTADS, traced the history of the various changes that have taken place and their management. The management of agricultural revolution — the change from nomadic and shepherdic life — was the most difficult, he said. It brought about two major changes: the division of labour, which ushered in inequality, and the concept of power.

The second major change took place with the industrial revolution. This is still taking shape, by going through various phases,

through changes in the technological base. The industrial revolution brought about a major change in science — through the discovery of the method of discovery and in institutionalizing the system of discovery. The management of this change has gone on increasing in complexity and even now one finds it difficult to manage. The institutions which manage science and technology, R & D, i.e. the instruments of change, have stereotype rules and regulations which do not promote and manage change but check and control change.

Presenting a generalized picture of management of change, Prof. Rahman said that four basic elements need to be considered: (i) Inheritance — one does not start a change on a clean slate. The social ethos, which is a part of inheritance, has a vital role to play. (ii) Management of humans who feel threatened by change. (iii) Rate of change of technology and its diffusion. (iv) Outlook or the vision, which is nebulous and cannot be quantified, but is vital to give direction and purpose to change and its management.



Prof. A. Rahman, former Director of NISTADS, speaking at the conference on The Management of Change

For India, the vision for change and the building of the necessary framework for its management was provided by the Science Policy Resolution of 1958. However, global changes, as well as India's experience over the last four decades necessitates the new vision, Prof. Rahman added.

Dr A.K. Bagchi, Director, Centre for Studies in Social Sciences, Calcutta, spoke on the interface of technology and economy. He emphasized the necessity of rethinking carefully about the ways in which science and technology can be related to the society. We should think of scientific and technological development in terms of processes of absorption of technology, its diffusion and its adoption and further development. In order to improve technological product, government should prepare proper economical and social policies, Dr Bagchi opined.

Dr Radhika Ramasubban, Senior Fellow, Centre for Social and Technological Change, Bombay, said that technology is the root of social and economic changes. Before we go for a change, we should take into account the experiences of others. Slowness has given us an opportunity to understand the world. Absorption and utilization of adopted technology is not an easy task. Before importing a technology, we must consider whether the Indian private industry would be able to absorb the technology or not. To provide scientific dimensions to the rural development, junior scientists may be asked to go to rural areas to implement scientific programmes in these areas, in collaboration with the local voluntary agencies and public administration, Dr Ramasubban suggested.

Dr G. Thyagarajan presented his paper on 'The Control of Critically Important Technologies',

covering the aspects. Interactive dimensions of technological changes, Sources for technology innovation and development, Choice of technologies for different socio-political structure, Power of technology base, Global technology scenario, Status of India in the current technology scenario, Diminishing value of natural resources, etc.

Suggesting a technology mix for India, Dr Thyagarajan said that India can no longer depend heavily on technologies for natural resource extraction and processing alone. The country has to evolve a strategy for technology prioritization taking into account the social weave of the country.

"The mass production sector is essential because there is a massive population whose demands are to be met. Production by the masses is essential because the single large resource in the country is her very people for whom the technological development is meant". "Critically important technologies are characterized by the speed of their change, power, scope and direction". Dr Thyagarajan added.

He further said, "Micro-electronics and automation, communication, bio-technology, new materials, energy and information come under my category of critically important technologies. They tend to have impact on one another, mostly in a synergistic fashion, resulting in new products, new processes, new systems and new world order".

"What is more needed in the development of technology missions in the country is a fiscal policy, a coordinated effort, a coherent plan of action to implement the technology programmes and above all the will of the nation to accord technology and technologists an upfront role and

build a strong technology base in critical areas". Dr Thyagarajan concluded.

The third session was chaired by Dr S.K. Joshi. Dr V.L. Dutt, President, FICCI and Chairman, KCP Group of Companies, spoke on Technology-Industry-CSIR Interface. He remarked that there is a great gap between the development of technologies in the CSIR labs and their utilization by industries. This gap should be minimized. Technologies developed in research laboratories should be result oriented. Industries are dependent on the national research laboratories, so there must be a good interaction between CSIR scientists and R & D industries. He emphasized for improvement of our products to come in the global competition.

Speaking on: Management of Change: Case Study of CSIR, Dr S.R. Valluri, former Director of the National Aeronautical Laboratory, Bangalore, cautioned the government about confusing the industrial production base upgradation, which will result from the new Industrial Policy, with the upgradation of the technology base. He stated that the difference between the two is that the technology base, which is inherently self-generating, is concerned with an understanding of the scientific, engineering and design principles which will make new product development and improvements within the country possible. An industrial production base, how-so-ever latest the production technologies may be, does not give this strength. He stated that without this, we can never hope to join the cadre of developed nations. He pointed out that four decades of licensed production since independence brought us no nearer to technological self-reliance and the new Industrial Policy is not likely to bring us any nearer.

Dr Valluri argued that the primary initiative to obtain technological self-reliance must come from industry, with its corporate R&D and design bureaus taking the initiative and the academic and research institutions doing the spade work in an interactive manner. He quoted examples of R&D expenditure from the developed world and India in support of his statements. He said that if the industry is not seriously interested in achieving this objective, R&D in the industry and in organizations like CSIR would lose much of its relevance.

The new Industrial Policy would seem to Hobson's choice and we may well be striking a Faustian bargain, in that it has become inescapable and if we are not careful in implementing it we may unwittingly derail the goal of achieving a measure of technological self-reliance. The only way out seems to be to make design offices, the R & D of the industry and relevant research laboratories responsible for unravelling the scientific, engineering and design principles that lead to the product develop-

ment in the first instance and take the initiative to develop the next generation products within the country. This way, as the time goes by, we can reduce continued dependence on others. If this is not planned and implemented as a deliberate policy, the present alienation among them would continue, resulting in widening of the technology gaps and leading to continued dependence on production through imported know-how in the name of upgradation of technologies, Dr Valluri stated.

He suggested that the government should give additional tax incentives to the industry for expenditure on R&D. For companies with foreign equity participation, the government should insist that the R&D expenditure within the country as percentage of sales shall not be less than that the amount spent by the company for R&D.

Dr Valluri further suggested that CSIR should uniformly introduce zero based budgeting in its laboratories; provide incentive of complete retention of income from

sponsored projects by the concerned laboratories; and sanction of funds to clearly defined programmes which should have potential for large amplification of benefits to the country. He suggested that the government should also make its budget allocation to the CSIR based on similar principles instead of fixing it on the basis of previous years actuals and arbitrary increases thereon.

A panel discussion was organized on: Where do we go from here? Ms Indira Jaising, Editor, The Lawyers Collective, Bombay; Prof. Rajni Kothari, Hon. Sr. Fellow, Centre for Study of Developing Societies, New Delhi; Shri Lovraj Kumar, Retd Secretary to the Government of India; Air Comdr. Jasjit Singh (Retd), Director, Institute for Systems Studies and Analysis, New Delhi, and Shri Jaswant Singh, M.P., were the panelists and Shri Ashok Parthasarathi, Additional Secretary, Ministry of Science & Technology, the moderator. Dr Ashok Jain, Director, NISTADS, summarized the proceedings of the conference. □

## **CENTRAL BUILDING RESEARCH INSTITUTE, ROORKEE**

### **R&D Highlights : 1990**

The major R&D activities of the Central Building Research Institute (CBRI), Roorkee, during 1990, continued to be in the area on low-cost alternative building materials and components. Concerted efforts were made to transfer technologies, developed by the Institute, to rural and urban settings throughout the country. Significant contributions were made in popularizing the housing activities by demonstration of construction techniques, training of artisans and organizing technical exhibitions. Technologies were developed for the utilization of flyash and other agro-industrial

wastes to reduce environmental pollution.

The institute made significant contributions to the development of computer software, tackling of landslide problems, diagnosis and identification of remedial measures of super and substructures, evaluation of plastic-based building components, performance assessment of building materials and components for their fire, thermal and acoustic characteristics, and tackling problems related to foundation-soil interaction.

There was a spurt in utilizing the services of the institute in find-

ing solutions for technical problems faced by the building industry. The institute handled 104 consultancy projects, of which 31 were taken up during 1989-90, in addition to 17 sponsored projects. Total cash flow generated from consultancy, sponsored and testing services amounted to about Rs 26 million.

The institute continued to be associated with UNCHS-USSR-CSIR programme of cooperation on technology transfer of building materials and components for the developing countries. At a meeting held in Riga/USSR in September 1989, preliminary technology

profile on technologies useful to developing countries prepared by CBRI/SERC and other CSIR laboratories and Latvian Building Research Institute, Riga, were discussed and a combined report on technology was brought out in December 1990. UNCHS had sponsored a project for the development of improved process for brick manufacture at Sri Lanka. The CBRI-designed kiln has since been commissioned and proved very successful.

Experiments carried out at the laboratory on utilization of copper tailings (Singhbhum) and zinc tailings (Zwar mines) showed that copper tailings could be utilized for manufacturing bricks having compressive strength  $100-200 \text{ kg/cm}^2$  with 10% lime and followed by autoclaving at  $14 \text{ kg/cm}^2$  for 6 h. Since Zn tailings are siliceous and dolomitic in nature, these can be used as a source of silica as well as lime for producing calcium silicate bricks. Zn tailings after calcination at  $1000^\circ\text{C}$  can be used as lime and by addition of 30-40 % of this lime to uncalcined tailings, bricks of strength  $100 \text{ kg/cm}^2$  could be produced after autoclaving of  $14 \text{ kg/cm}^2$  for 6 h.

A moving grate sinter strand pilot plant (capacity 1-1.5 tonnes/8 h) was shifted from Roorkee to Triveni. Light-weight aggregate produced (B.D.  $700 \text{ kg/m}^3$ ) was evaluated for concrete making properties; 1:1.5:3 cement, sand and light-weight aggregate by volume was found suitable (B.D.  $1900 \text{ kg/m}^3$ ) for use in RCC roof slab and other structural materials. A light-weight polymer concrete using a low-cost indigenous resin binder and cinder (railway waste) as aggregate was developed as an alternative thermal insulation-cum-water proofing treatment for roofs.

The institute along with the Indian Institute of Chemical Technol-

ogy (IIT), Hyderabad, developed a sandwich type plastic composite panelling material using plastic foam as core and plywood sheets as surfacing materials for use in partitions and flush doors, etc. A low-cost interpenetrating polymer network based on polyurethane and cashewnut shell liquid was developed for core of composite panels.

A cost effective waterproof coating compound based on polyurethane polymer was developed using indigenous polyol, jointly with NCL-Pune.

A fuel efficient wood fired fixed chimney (14 m high) kiln of 15,000 bricks/day capacity was designed and suitable cast iron dampers for efficient control of draught and



Block making machine



Concrete panel house under construction

movement of flue gases through bricksettings were provided. Agro-wastes, such as rice husk, saw dust, wood chips, etc., can also be used as a fuel in the kiln.

The institute developed a method for using white glazed china broken pieces of bathroom tiles for roof top surfacing of buildings by applying the principle of Reflective Heat Insulation. In order to avoid any stagnation of water on roofs, resulting in erosion of cement joints between pieces of tiles, enough slope/gradient in roof as per I.S. specifications is provided. Aquaproof-inorganic water proofing solution developed by the institute, mixed with cement mortar (1:3) acts as a suitable binder for the joints of tiles. These tiles when embedded in roof surface were observed to reduce roof, ceiling and indoor air temperatures upto 16°C, 12°C and 3°C respectively. Three coats of washing treatment further reduced the temperatures upto 8°C, 4°C and 1°C respectively.

The institute developed a software for evaluating lighting and thermal designs of buildings in terms of daylight distribution, indoor environment temperatures, heat gains and energy requirement for cooling, heating and lighting of buildings for different climates.

In order to develop low-cost fire retardant wood based products, an alternative adhesive (lignin phenol formaldehyde) was being developed using waste product (black liquor) of paper and pulp industry. Lignin was extracted from black liquor and its elemental, functional and spectroscopic analyses were carried out. To obtain lignin phenol formaldehyde (LPF) resin, copolymerization of lignin with phenol and formaldehyde was studied.

A few particle boards of rice husk using LPF resin were made under controlled conditions of temperature and pressure.

In order to reduce fire losses in cable installations, a fire retardant

sealant was developed based on indigenously available chemicals, which arrests fire through penetration.

The Foundation Pile Demonstration System (FPDS) was successfully used for conducting various tests on different types of piles. The results obtained clearly demonstrated efficacy of the system for detecting defects and continuity of installed piles soon after construction, for monitoring performance of piles during driving and for conducting dynamic load tests to determine static bearing capacity of piles using the methodology based on one dimensional stress wave approach. In order to assess performance of jointed precast concrete piles during driving and after their installation, to assess the performance of piles driven by different types of driving hammers, to utilize the integrity testing methodology and its results for quality control and improvements in piling techniques at live project sites and to prepare a base for interpretation of integrity test results more precisely, the institute conducted Pile Driving Analysis (PDA) tests on single length and jointed precast concrete piles, Integrity tests on jointed precast concrete piles on bored cast-in-situ concrete piles, and Dynamic Load Tests (DLT) on single length precast concrete piles.

The ground Penetration Radar Technology was successfully deployed for non-destructive sub-surface interface profiling at a site in western coast of Maharashtra. The laterite soil cover of 3-4 m thick and subsequent soil rock interface were clearly delineated and the technology was found very powerful in locating buried pipes and cables.

Soil blocks from different panel walls (1 × 1 × 0.2m) were cut and cast with slurry mud and rein-

Demonstration of  
precast DC tiles in  
Riga (USSR)





forced with different fibres such as glass, netlon mesh and bamboo strips, etc. and out of this block 10 cm cube samples were prepared. The panel walls were constructed for assessing the feasibility of casting walls with self-setting slurry poured into the formwork and to study the time taken for setting as well as foundation. Stress/strain characteristics of the samples carved from the blocks carried out at an interval of 3 months for a period of over a year showed that ultimate compressive stress for the panel wall samples varies between 3.4 to 4.7 kg/cm<sup>2</sup> with an average value of 4 kg/cm<sup>2</sup> in January. However, this strength further increased to an average value of 5 kg/cm<sup>2</sup> during peak summer in May.

Successful field application of the technology on granular piles and skirted granular piles as foundations of multistoreyed buildings, power houses, oil drilling rigs, small and large size oil storage tanks and their performance in loose-medium dense cohesionless soils and soft saturated clay deposits is a step forward in the development of efficient speedy and cost effective foundations.

In the area of Rural Buildings and Environment, two types of houses costing within Rs 8000, out of four alternatives, were finalized in consultation with the District Magistrate, Saharanpur, for the beneficiaries of the Indira Avas Yojana.

Ferrocement is being used since long in housing, particularly in making overhead water tanks, grain storage bins and septic tanks, etc. in different sizes and shapes. To bring down their cost without altering the materials used, the laboratory developed a new technology to ensure better strength and performance against leakage. The new technology consists of a mould mounted on a lead

screw connected to an operating handle through a bevel gear set for moving it up and down. A casting platform is made around the mould. The ferrocement unit is cast over the mould and after proper setting, the mould is lowered down leaving the unit on a casting platform from where it is taken for curing.

The laboratory carried out detailed study on the performance of various types of buildings during the cyclone of November 1989 in Nellore and Prakasham districts of Andhra Pradesh to find the various causes of failure of buildings and to develop appropriate technology for the region.

Prestressed Cement Concrete (PCC) poles are extensively used in transmission and distribution of electric power in rural areas and urban townships. The institute developed a Direct Electric Curing (DEC) technique for accelerated curing of PCC poles for their mass production. For conducting laboratory trials, a set-up was fabricated and installed at the institute, comprising 40 tonnes (9 m long) prestressing frame with detensioning arrangement, twin cell steel moulds (7.5 m long) for horizontal and vertical casting of poles along with plate electrodes of suitable configuration and testing facility for testing of full size PCC pole as per IS specifications.

The institute designed and developed an electronic automatic spraying control device for the building complex of Solar Energy Centre, Department of Non-Conventional Energy Sources, Ministry of Energy. The Complex has single and double storeyed blocks having sixty RCC cylindrical shell roofs (8 cm thick and nearly 50 m<sup>2</sup> roof surface area each). The device has been deployed on coir matting laid on the roof of the shells so as to just keep it in a water soaked condition day and night throughout hot

periods. It does not allow any accumulation of water on roof surface. A faulty section indicator with audio visual alarm in the technician's cabin has also been introduced. Also, a new design of a nozzle has been developed to spray water uniformly and intermittently. □

## Rust Converting Primer

In the normal practice the surface of the rusted mild steel is prepared either by sand-blasting or pickling, followed by phosphating prior to the application of the primer. The surface preparation of the metal is necessary so as to have good adhesion of the primer over the metal, since the bonding between metal and primer is of mechanical nature. Phosphating is done to further improve the adhesion of the primer over the metal. If the rust is present on the surface of the metal, the adhesion of the primer will be poor leading to complete failure of the entire coating system used for the protection of steel structure. The avoidance of steps such as sand blasting and phosphating will considerably reduce the cost involved in the protection of steel structures.

The Central Electrochemical Research Institute (CECRI), Karaikudi, has developed a new process for rust converting primer, which avoids steps such as surface preparation and phosphate treatment given to the mild substrate prior to the application of primer. It is a single pack system and contains chlorinated rubber, water, phosphoric acid, xylene, isopropanol and other additives. The constituents are stirred well before application over the rusted surface.

The suggested minimum economic capacity is 30 tonnes per annum and estimated total project

cost works out to Rs 0.43 million. All the plant and machinery and raw materials needed are indigenously available. As the rust converting primer is not available at present in India, the product will have wider market potential.

The profit is expected to be about 90% on the estimated turnover of Rs 1.7 million. □

### **High Temperature Elatec Alvac I Multipurpose Furnace**

The Regional Research Laboratory (RRL), Bhopal, has recently commissioned a high vacuum high temperature furnace capable of working up to 2000°C and under vacuum level of  $10^{-2}$  to  $10^{-3}$  m bar and/or inert gas atmosphere. The furnace, designed and manufactured by NEF OY Finland, has many rare research facilities for engineering ceramics and metals. It is capable of performing various operations like sintering, heat-treating and processing of ceramic materials. Further, high tempera-

ture metals particularly those prone to oxidation can be heat-treated and processed under controlled inert gas and vacuum. The effective hot zone at 2000°C is 6" x 6" size consisting of graphite heating elements. The heating cycle can be set through a microprocessor based programmable PID temperature controller system. The controller is capable of keeping in memory 6 numbers of heating cycles each consisting of up to 16 segments. This furnace has got another unique feature of flow trap system which helps in trapping the binding materials and other volatile materials evolved during the heat-treatment. □

### **Process for Manufacture of Blended Vegetable Tannin Extract**

Vegetable tannins are by far the best tanning agents from filling as well as tanning points of view. Because of the growing awareness of environmental degradation caused

by man-made chemicals and consequent increasing demand for environment friendly materials, there has been a revival of the demand for vegetable tannin blends. Some months back, M/s Rallis India had approached the Central Leather Research Institute (CLRI), Madras, for development of know-how for the manufacture of blended vegetable tannin extract from myrobalan nuts, babul bark and cashew husk on a sponsored/consultancy basis. After successful completion of the laboratory scale development, CLRI was also assigned the task of supplying the basic design engineering data to the firm. CLRI has nearly completed this task of developing a most modern microprocessor control system, replacing the age-old process of extraction in vats/tubs and pits. The pilot plant is now ready and will soon go into production. □

### **Novel Liquid Membrane Electrodes**

The Central Electrochemical Research Institute, Karaikudi, in a tripartite agreement with the Department of Science and Technology (DST), New Delhi and M/s pH Products Company, Hyderabad, has finalized the terms for releasing the know-how for making novel liquid membrane electrodes for commercial exploitation. The work carried out by the institute under a sponsored programme of DST resulted in the development of potassium, ammonium, and nitrate ion selective electrodes of a novel liquid membrane type. The working range of concentrations for the different ions are comparable to those reported in literature. The terms of release are: lumpsum premium: Rs 24,000, recurring royalty: 5% and period of license: 5 years. □



High temperature Elatec Alvac I multipurpose furnace  
commissioned by RRL - Bhopal

## **CSMCRI assists NFI to recover bromine from downstream of HALON Plant**

Bromine has multifarious end uses in photography, medicine, insecticides, fumigants, dyes, etc. Of late, it is finding increasing use in the manufacture of fire-extinguishers and fire retardants. Recent demand predictions indicate that in our country about 2000 tonnes of bromine will be required every year by the end of this decade. Enough number of bromine plants to produce bromine from sea bittern have not yet been installed by salt manufacturers. Hence a part of the bromine requirement is met through import.

During bromination of organic compounds either hydrogen bromide or other bromides are

produced as byproduct. In the replacement reaction, as much as 50% bromine comes out in the form of hydrogen bromide, as was the case with M/s Navin Fluorine Industries, Surat, who approached the Central Salt and Marine Chemicals Research Institute (CSMCRI), Bhavnagar, to provide assistance to recover bromine based on the expertise from their downstream of HALON plant. Based on the data provided by NFI, the plant details were worked out by CSMCRI. The entire plant with mostly glass equipment was fabricated by a Vadodara based company and installed in the premises of NFI at Bhestan near Surat. It was commissioned by CSMCRI in the first week of June 1991.

Investment on the plant came to around Rs 6 lakh. The unit can recover about 250 kg of

bromine/day from the downstream of NFI's HALON plant. Prof. M.M.Taqi Khan, Director, CSMCRI, inaugurated the plant on 9 September 1991. □

## **CMRS Testing Cell**

The Central Mining Research Station (CMRS), Dhanbad, has reorganized its testing facility procedure and created a cell named 'CMRS Testing Cell' so as to give better services to its users and for best utilization of this national facility.

The cell provides a 'Single Window Assistance' to the mining and allied industries and manufacturers of mining equipment/machinery in all its matters related to testing and calibration.

The users should submit their application/drawing material for testing and or calibration to the CMRS Testing Cell. The job will be assessed and processed by the cell and the necessary certificate will be issued. □

## **CLRI investigates the accident at Maharashtra Gas Cracker Complex**

The Government of India appointed a High Level Enquiry Committee for the investigation of the major accident which occurred at the Maharashtra Gas Cracker Complex (MGCC) at Nagothane on 5 November 1990. The Cell for Industrial Safety and Risk Analysis (CISRA) at the Central Leather Research Institute (CLRI), Madras, was assigned the responsibility of reconstructing the accident scenario with the help of mathematical modelling and simulation and related scientific investigations.

Bromine plant commissioned by CSMCRI



CISRA investigations covered a wide range of scientific studies including estimation of source strength of the hydrocarbon leak modelling of vapour cloud formation, its growth, dispersion and ignition, thermal radiation effects from flash, pool and jet fires, simulation of surge effects and transient temperature profiles in cryogenic fluid pipelines etc.

CISRA team examined several accident scenarios to establish their credibility before suggesting the most probable event sequences of MGCC incident. The scientific report was submitted to the High Level Enquiry Committee in July 1991. □

### **Development of Leather Auxiliaries by CLRI**

The Central Leather Research Institute (CLRI), Madras, has developed a leather preservative based on TCMTB and standardized a bench scale (0.25 kg) process on sponsorship basis for a private company. The product is being tested for efficacy on different leathers. Preliminary results show the performance of the product to be satisfactory.

Know-how for phosphorilated fatliquor on non-edible oil, viz. castor oil, was developed for the first time indigenously, under a consultation project undertaken for a public sector undertaking. The process was successfully demonstrated to the party at the pilot plant (70 kg/batch). The product was evaluated as a constituent in the blended synthetic fatliquoring compositions against the marketed products in processing of softy cow uppers.

A know-how for water repellent, based on a semidrying vegetable oil, such as cotton-seed oil was developed under a spon-

sored project from a public sector undertaking and the bench scale process (1 kg level) was successfully demonstrated to the party. The product was evaluated for its efficacy against marketed products and it was found to give satisfactory results.

A process was standardized at bench level (0.5 kg/batch) in respect of a cationic urethane filling agent for application in processing of upper leathers. Evaluation of the product is on hand.

A process for reactive polyacrylate dispersion free of emulsifiers was standardized at the bench (0.5-1 kg) level meant for use in finishing and crosslinking of leather surface films.

Know-how was developed for the preparation of polyurethane emulsions as both medium soft and soft binders for use in leather processing in the place of acrylate binders, with improved characteristics on leather in respect of feel, gloss, flexibility, water repellance, etc. This know-how (bench scale at 0.5 kg level) was developed under a sponsored project from a private firm. Performance on cow upper leathers was completed with satisfactory results. □

### **Seminar on Leather and Leather Products Export**

A Seminar on Leather and Leather Products Export was organized by the Rotary Club, at Vaniyambadi on 4 September 1991. Speaking at the seminar, Dr K.V. Raghavan, Deputy Director, Central Leather Research Institute, (CLRI), Madras, informed that under the aegis of an integrated mission programme of the Eighth Plan on modernization of the leather industry, extensive

scientific investigation was being pursued by CLRI to develop the know-how and design engineering packages for commercial exploitation. This programme received a significant boost in 1990. The technical objective of the programme was upgradation of quality control of the finished leather.

Dr M. Mallikarjunan of CLRI, spoke about the overall benefits of computer-assisted operation in leather processing. Dr G. Thyagarajan, Director, CLRI, touched upon the overall benefits of modernization and introduction of computer in tanning industry. □

### **Computerized Database Search at NICFOS**

The National Information Centre for Food Science and Technology (NICFOS) at the Central Food Technological Research Institute (CFTRI), Mysore, has developed facilities for computerized database search of the world literature in Food Science and Technology and related disciplines. Retrospective search-service facility extending up to about 20 years is available on nominal payment basis. Titles alone or with abstracts can be requisitioned as per the needs of the intending users. Further details can be had from The Head, NICFOS, CFTRI, Mysore 570013. □

### **Biochemical studies on heavy metal toxicity in water hyacinth weevils *Neochetina eichornae***

Shri Mohd, Saber Hussain, while working at the Indian Institute of Chemical Technology (IICT), Hyderabad, made studies on the heavy metal toxicity in water hyacinth weevils *Neochetina eich-*

*hornae* Warner. The studies were aimed at understanding the metal pollution in the environment and its implications in a biological system.

The water hyacinth plants, *Eichhornia crassipes* (Mart) Salms, treated with Zn, Cd, Hg and Pb metals were source of food for the water hyacinth weevils. The bioaccumulation of these four metals in the plants was amazingly high, 70-85% at 25, 50, 75 and 100 ppm concentrations of the metals. The distribution pattern of these metals however varied in the plant tissues; much of the metal content was retained in the roots followed by petioles and then leaves. The plants exhibited preferential uptake; Pb & Hg uptake was lower than Zn, as determined by Atomic Absorption Spectroscopy and ICP-AES.

The insects feeding on these metal-treated plants showed variations in the bioaccumulation patterns of these metals. The biotransfer of these metal ions into the insect bodies varied between 6-9% of the concentration present in the lamina of the treated leaves. The metal ions which entered through the trophic levels of food chain of the insects profoundly affected the protein syntheses. The decrease in the total protein was related to the concentration of metal accumulated in the insect body. Similar decline was observed with nucleic acids (DNA & RNA content). The variations within individual metals were dose-dependent. The results with Zn were rather striking, as formation of complexes with aminoacids and peptides is possible. Cd and Pb interfered in the protein synthesis at the transcription level. However, with Zn ion, the total proteins increased and the insects indicated a higher fertility and fecundity rates. The studies showed that heavy metals are translocated from polluted

waters to the plant system and subsequently to the insect body. It was observed that though feeding behaviour and fecundity of insects was affected, they could still avoid the extreme effects, i.e. mortality. However, biochemical variations existed with various metal treatments. Results show that Hg, Cd and Pb ions inhibit protein and nucleic acid synthesis while Zn has opposite effect. Alanine amino transferase (ALAT) and aspartate amino transferase (AAT) activities suggest that they can influence gluconeogenesis and subsequently energy metabolism to cope up with metal toxic stress. Electrophoretic studies indicated that the accumulation of metal ions in insect bodies caused changes in protein profiles as evident by the disappearance and appearance of several bands when compared to controls. This indicates the possible interference with normal metabolism of protein and nucleic acid synthesis.

The studies show that *Neochetna* weevils, which are used as biocontrol agents to control water hyacinth, could be influenced by heavy metal pollution.

The accumulation of hazardous metals in the insect body may enter the food chain through predatory arthropods, frogs and insectivorous birds. This work throws light on the implications of environmental metal pollution in a biological system.

Shri Hussain carried out these studies under the supervision of Dr (Smt) Kaiser Jamil of IICT and was awarded Ph.D. degree by the Osmania University. □

## CECRI celebrates Foundation Day

The Central Electrochemical Research Institute (CECRI), Karaikudi, celebrated its 44th Foundation Day on 25 July 1991. The Foundation Day Lecture was delivered by eminent educationist and Vice-Chancellor, Indira Gandhi National Open University, New Delhi, Dr V.C. Kulandaismamy. A Scientists-Industry meet was also organized on the occasion.

Speaking on the occasion, Prof S.K. Rangarajan, Director, CECRI, stressed the need for maintaining



Dr V C Kulandaismamy delivering the CECRI Foundation Day lecture

the credibility level of scientific community in the society and in the industry. Enumerating the progress of CECRI during the last one year in terms of processes, patents, grant-in-aid and sponsored schemes, consultancies etc., Prof. Rangarajan pointed out that mere number is not so important, it is the involvement of many agencies such as Defence, NRDC, DST, DOD and the private sector, which is more important. He mentioned about the environment friendly technologies such as the membrane cell for the chlor-alkali industry and the bipolar cells for magnesium. Prof. Rangarajan disclosed that CECRI's know-how for magnesium is going to be utilized by the Zirconium-Titanium Complex envisaged at Tuticorin in Tamilnadu. Prestressing of steel for concrete bridges, electroforming of rocket engines, selective anodization for space applications, deep discharge lead acid batteries for literacy mission, biosensors, conducting polymers, etc., were some of the significant contributions of CECRI in the recent past. He stated that the future applications of electrochemistry will relate to programmes such as molecular electrolysis, electrocatalysis, electric vehicles and biosensors.

Prof. V. C. Kulandaiswamy in his Foundation Day Lecture paid rich tributes to Dr R.M. Alagappa Chettiar, who played a vital role in establishing CECRI at Karaikudi and the Ramanujam Institute of Mathematics in Madras.

In his lecture Prof. Kulandaiswamy observed that the poor dissemination of knowledge in the developing countries is largely responsible in preventing the benefits of S&T reaching the common man. He was highly critical about the poor scientific temper and the indifferent industrial culture prevailing in our country. Speaking on the growth of science

in India, Prof. Kulandaiswamy said that peaks of achievements are there, but the base has also to be lifted. He emphasized the need to improve the management systems.

Prof. R. Kumar, Department of Chemical Engineering, Indian Institute of Science, Bangalore, released a brochure on CECRI — A National Centre for Corrosion Testing, on this occasion.

Dr G. Prabhakara Rao, Deputy Director, CECRI proposed a vote of thanks.

#### Scientists -- Industry Meet

The Scientists - Industry meet was attended by a large number of delegates from many electrochemical industries including Chemfab Alkalis, Burroughs Wellcome (India) and SPIC.

Prof Rangarajan, in his introductory remarks, stressed the need for closer interaction with the industry for making R&D efforts to be more useful.

Prof. M.M. Sharma, Chairman of the Technical Advisory Board, Chemical Technology Group of

CSIR, discussed the importance of electrochemicals and the advantages and disadvantages of the electrochemical approach for the production of various inorganic and organic chemicals. Prof. Sharma emphasized that the environmental aspects in the chemical manufacturing processes should be given due consideration.

Two presentations were made by scientists of CECRI. Presenting a paper on Chlor-alkali Industry in Nineties, Shri S. Krishnamurthy traced the entire development of the industry and CECRI's contribution in the field. He discussed in detail the technology on monopolar and bipolar membrane cells developed by CECRI. CECRI's membrane cell technology consists of a total technology package which includes anode coating, cathode coating and a simple brine purity monitoring system. CECRI's special catalytic cathodes for use in zero gap cells are another important contribution. Energy recovery by using the byproduct of hydrogen from the caustic soda cell coupling the H<sub>2</sub>-O<sub>2</sub> cell for energy produc-



A view of the membrane cell demonstration held at CECRI



tion is another approach being attempted at CECRI.

Dr K.C. Narasimham, Head of the Electrochemicals Division, CECRI, presented a paper on Electrochemical Industry — Present and Future. He gave an account of CECRI's technologies for the production of chemicals such as potassium iodate, sodium hypochlorite, magnesium chlorate and perchlorate, glyoxylic acid, succinic acid, calcium gluconate and eosin. The projects in the pipeline as well as the Indian scenario in regard to the future possibilities of production of electrochemicals were also indicated. Dr Narasimham opined that choice of electrochemical or chemical routes in syntheses of organic and inorganic chemicals is to be made with due consideration to the economics as well as environmental factors.

A demonstration of CECRI's membrane cell technology was also arranged on the occasion. Membrane cell is the next generation cell in caustic chlorine technology and a corollary to the development of Titanium Substrate Insoluble Anode (TSIA). The membrane cell involves an anode (TSIA) and a cathode, separated by a cation exchange membrane. The advantages are two fold, viz. it is environment friendly, since the use of mercury or asbestos in cells is done away with and the new technology results in greater saving in electrical energy to the tune of 700 kWh/ tonne. The novel features of CECRI's membrane cell process are: (a) Modified metal anode for longer life, (b) Catalytic cathode which brings down the voltage by 200-250 mV, (c) 700 units of energy saved per tonne of caustic soda, (d) space requirement reduced by 50% and (e) pollution free technology. □

## ICICI Team visits IIP

The Industrial Credit and Investment Corporation of India Limited (ICICI) has recently launched a new scheme known as SPREAD (Sponsored Research and Development Programme) to encourage Indian industries to step up their R&D activities and linkages with the national laboratories. The World Bank has provided necessary financial support to this programme. The SPREAD programme of ICICI would lead to commercialization of a technology.

A public sector company and two private companies involved in the manufacture of carbon products and additives respectively approached ICICI to support specific R&D programmes in collaboration with the Indian Institute of Petroleum (IIP), Dehra Dun, leading to the development of a technology in a few selected vital sectors. Because of the pioneering role of IIP and its strategic expertise available within the institute, these companies and ICICI are actively considering such collaborative effort with IIP.

A team of Experts of ICICI, led by Shri A.T.Kusre, Manager, Technology Group, visited IIP on 5 and 6 August 1991 and had extensive discussions with Dr T.S.R. Prasada Rao, Director, IIP, and concerned scientists to review the possible project linkages between IIP and these industries. A Memorandum of Understanding (MoU) on one project was signed on 5 August 1991 between IIP and a leading carbon product manufacturing company, as a result of these initiatives. □

## Indian Trade Exhibition

CSIR participated in the Indian Trade Exhibition, held at Windhoek, Namibia, during 16-22

September 1991. It was organized by the Trade Fair Authority of India. The exhibits from various CSIR laboratories viz. Central Salt and Marine Chemicals Research Institute, (CSMCRI), Bhavnagar; Central Leather Research Institute (CLRI), Madras; Central Drug Research Institute (CDRI), Lucknow; National Chemical Laboratory (NCL), Pune; Central Scientific Instruments Organisation (CSIO), Chandigarh; Central Glass & Ceramic Research Institute (CGCRI), Calcutta; Central Food Technological Research Institute (CFTRI), Mysore, and the Publications & Information Directorate (PID), New Delhi, were put on display in the exhibition. The President of Namibia, Dr Sam Nujoma inaugurated the exhibition. Many cabinet members and Shri Shiv Mukherjee, High Commissioner of India, were present at the inaugural function. Mr Hage G. Geingob, Prime Minister of Namibia, also visited CSIR stall, along with the President of Chamber of Commerce, Namibia.

The CSIR technologies, viz. leaf cup making machine, ceramic hip joint, the encyclopaedic publication of PID — *The Wealth of India*, guggulipid and various leather technologies evoked tremendous interest among the viewers. On the request of Minister of Sports & Education, Government of Namibia, a set of *Wealth of India — Raw Materials*, was presented to the library through Shri Mukherjee. People from neighbouring countries like Botswana, Malawi and Angola also visited the CSIR stall.

A seminar entitled, 'India as Trade Partner' was also organized during the exhibition. Shri T.D. Nagpal, Head, Unit for Science Dissemination, CSIR, also attended the seminar and dissertated on various CSIR technologies relevant

to the host country. Wasteland Technologies for the desert region, desalination of brackish water and

gugulipid evoked keen interest among various VIP's. □

presented. Over fifty delegates representing central and state government agencies participated in the workshop. □

## **Water Resources Day and Workshop on Recent Advances in Water Resources Management**

At the Regional Research Laboratory (RRL), Bhopal, 14 May 1991 was celebrated as Water Resources Day. The theme for this year was 'Water Conservation'. The function was inaugurated by Shri Shitala Sahai, Minister, Water Resources, M.P.

A one-day workshop on Recent Advances in Water Resources Management, sponsored by M.P. Council of Science & Technology, was also held coinciding with the Water Resources Day Celebrations.

Speaking on the occasion, Shri Sahai stressed the need for a scientific approach for harnessing the surface and ground water resources of the region. He expressed confidence that with rigorous efforts of scientists and engineers towards designing of optimum methods of water conservation, prospecting and supply, a new era of meaningful development will dawn in the State of Madhya Pradesh. He complimented the M.P. Council of

Science & Technology and RRL-Bhopal and all the participating agencies for coming together to discuss issues in the Workshop on Recent Advances in Water Resources Management.

Dr D.N. Mishra, Director General, M.P. Council of Science & Technology, outlined the objectives of Water Resources Day celebrations and the workshop. Shri M.S. Billore, Secretary, Water Resources (M.P.) delivered the key note address.

Prof. T.C. Rao, Director, RRL, Bhopal, welcomed the dignitaries and guests and mentioned that the RRL, Bhopal shall endeavour to play a nodal role in S&T activities related to natural resources of M.P.

The workshop had a session each on Groundwater Exploration and Conservation; and Water Resources Management. In all thirteen technical papers were

## **Rural Leather Industry —Get-together and Exhibition in Rajkot**

The Central Leather Research Institute (CLRI), Madras, organized a get-together of Rural Leather Industry at its Rajkot Regional centre on 30 March 1991, as a part of Dr Ambedkar's Birth Centenary Celebration. Over 80 delegates from various organizations in the state, tanners, footwear and leather product manufacturers, raw hides & skins and leather dealers, etc. attended the get-together.

Shri I.M.S. Patel, Scientist-in-Charge, of the Regional Centre, welcomed the participants and briefed them about the various R&D and extension activities of CLRI and its Regional Centres.

Shri Devendrakumar R.Desai, Secretary, Saurashtra Rachnatmak Samiti, Rajkot, in his inaugural address, appreciated the R&D and extension work of CLRI and the Rajkot Extension Centre. He called for intensive efforts for the social and economical upliftment of the rural artisans, and the weaker section of society, through science and technology. The leather industry has immense potentiality for providing employment in rural areas and earning foreign exchange, which should be fully exploited on scientific lines, remarked Shri Desai.

Shri P.K. Taneja, IAS, Rajkot District Collector, expressed his views on the Rural Development Programmes and the need for creation of awareness towards science and various schemes for the benefit of rural people.



Shri Shitala Sahai, Minister, Water Resources, M.P., inaugurating the Water Resources Day celebrations at RRL, Bhopal

Dr R.C.Trivedi, former Chief Industrial Adviser, Industries Commissionerate, Government of Gujarat in his address said that the Government of Gujarat was keen to develop leather industry in the State with the close collaboration of CLRI.

Shri M.B. Chauhan, Scientist, RCED (CLRI), Rajkot, conducted the proceedings and proposed a vote of thanks.

After the inaugural session a technical session was held, which was chaired by Shri P.P.Trivedi, Joint Director & General Manager, District Industries Centre, Rajkot. Shri Patel presented a keynote paper on Scenario of Rural Leather Industry - Transfer of Appropriate Technology. The paper highlighted the present status of industry in the country and the State, its scope and integrated development programme for the improvement of socio-economic and working condition of rural tanners, through application of science & technology, citing the work of the Rajkot Extension Centre, carried out at Idar, Badarkha, Bardoli, Rajkot, Jawaja, Sayla, etc.

An exhibition was also organized on the occasion which had exhibits such as tanned and finished leathers, footwear, leather products, animal byproducts made by rural/cottage units with CLRI developed rural technology, and charts depicting various R&D and extension activities of CLRI. □

## DEPUTATION BRIEFS

### National Workshop on Energy Information Handling

Shri B.K.Sen, Deputy Head, Education & Training Division, Indian National Scientific Documentation Centre (INSDOC), New Delhi, and Coordinator, National

Centre on Bibliometrics (a NISSAT Sectoral Centre) visited Islamabad to attend the National Workshop on Energy Information Handling as UNESCO resource person. The workshop was organized by the National Institute of Silicon Technology, Pakistan, during 12-16 May 1991. Shri Sen presented three papers - Energy Information Systems - an Overview; Energy Information Sources; and Energy Information - Consolidation and Repackaging. □

## TRAINING COURSES

### Leather Goods Training Programme 1990-91

The Central Leather Research Institute (CLRI), Madras, organized an 11-month Leather Goods Training Programme during August 1990- June 1991. Twenty-eight candidates from Delhi, Kerala, West Bengal, Andhra Pradesh and Tamil Nadu attended the training programme.

The course content covered aspects such as ornamental drawings, pattern cutting, industrial designing, skiving, pasting and operations on sewing machines. The trainees were exposed to economic marketing and export aspects of leather goods industry, government policies and entrepreneurial guidance. The candidates themselves made small items like wallets, handbags and luggage bags. □

### Integrated Training Programme on Low-cost Housing at Patna

The Central Building Research Institute (CBRI), Roorkee, organized a training programme on low-cost housing at Patna during 5-7 June 1991, in collaboration with the

Bihar Council on Science and Technology. Inaugurated by Shri S.N. Jha, Minister of Science & Technology, Government of Bihar, the programme had the participation of teachers from engineering colleges, engineers, architects, consultants, administrators, etc. representing 38 organizations (both government and private).

The programme comprised live demonstration of technologies appropriate to rural and urban regions., lectures, audio-visual presentations and group discussions.

The programme was the first of its kind in Bihar, and created lot of awareness among those engaged in the housing activity, regarding the recent developments related to low-cost building materials, sanitation and roads. □

## Honours & Awards

### INSA Fellowship and T.B. Patel Oration Award for Dr M.R. Das

Dr M.R. Das, Scientist in Director's Grade, Centre for Cellular and Molecular Biology, Hyderabad, has been elected to the Indian National



Science Academy. He has also been selected as the first recipient of the newly instituted T.B. Patel Award of the Gujarat Cancer Society on the occasion of its Silver Jubilee Celebrations. The award is to be given away by the Chief Min-

ister of Gujarat on 1 December. Dr Das is a Fellow of the Indian Academy of Sciences and the National Academy of Sciences. He is a recipient of several other awards such as the FICCI Award (in the field of Life Sciences), Ranbaxy Research Award (in the field of Medical Sciences). The Sreenivasayya Memorial Award of the SBCI (Outstanding Contributions in Biological Chemistry and Allied Sciences), ICMR Sandoz Oration Award (Molecular Biology of Cancer) and the Hari Om Ashram Alembic Award (Basic Research in Medical Sciences).

#### Dr N.S. Rengaswamy

Dr N.S. Rengaswamy, Scientist, Central Electrochemical Research Institute (CECRI), Karaikudi, has been awarded a cash prize and a scroll for his meritorious work relating to the Corrosion Science and Technology with a bearing on industrial applications, by Mascot Chemical Works, Bangalore, for

the year 1989, on the recommendation of the Council of Electrochemical Society of India, Bangalore.

#### Shri S. John

Shri S. John, Scientist, CECRI, Karaikudi, has been awarded the N.M. Sampath Award by the Electrochemical Society of India, Bangalore. This award instituted by M/s S. Mitra & Co., Bombay, has been given to Shri John in recognition of his meritorious technical services rendered in the field of electroplating.

#### Shri M. Raghavan

Shri M. Raghavan, has been awarded the Best District Chairman award by Lions Club International District 324 B3, for popularizing solar energy utilization in the Lions District during 1990-91, as District Chairman. □

## PATENTS FILED

187/DEL/91: A process for the preparation of rigid foams using naturally occurring agro-based, renewable raw material, B.G.K. Murthy, M.S. Ramalah, V. Madhusudhan, P.D. Sarma, K. Narasimhalah and M.M. Shirsalkar—Indian Institute of Chemical Technology, Hyderabad.

188/DEL/91: A process for preparation of zirconia by plasma dissociation of zircon, U. Syamaprasad, S. Bhattacharjee, R. K. Galgali and B.C. Mohanty—Regional Research Laboratory, Bhubaneswar.

190/DEL/91: A thermal plasma reactor useful for in-flight processing of refractory powders, minerals and ore fines, U. Syamaprasad, R.K. Galgali, S. Bhattacharjee, A.S. Rao and B.C. Mohanty—Regional Research Laboratory, Bhubaneswar. □



## वैज्ञानिक तथा औद्योगिक अनुसंधान परिषद्

## प्रकाशन एवं सूचना निदेशालय

### हिन्दी वैज्ञानिक और तकनीकी प्रकाशन निदेशिका : 1981-90

तृतीय विश्व हिन्दी सम्मेलन सन् 1983 में नई दिल्ली में हुआ था। इस अवसर पर 1966 से 1980 की अवधि में हिन्दी में प्रकाशित वैज्ञानिक एवं तकनीकी साहित्य की दूसरी निदेशिका सी.एस.आई.आर. द्वारा प्रकाशित की गई थी। राष्ट्रीय महत्व की इस निदेशिका का देश-विदेश के हिन्दी जगत में भरपूर स्वागत हुआ था। इस निदेशिका में हिन्दी विज्ञान लेखकों, सम्पादकों, अनुवादकों, प्रकाशकों एवं संस्थानों आदि द्वारा रची गई 3344 पुस्तकों और 320 पत्रिकाओं की महत्वपूर्ण जानकारी संकलित थी। निदेशिका लेखकों, पाठकों और प्रकाशकों को जोड़ने में सफल रही।

पिछले 1981 से 1990 के दस वर्षों में भी ढेर सारा हिन्दी वैज्ञानिक एवं तकनीकी साहित्य रचा गया है। अतः देशहित में आप सबकी जानकारी हेतु इस साहित्य का लेखा-जोखा पुनः एक नवीन निदेशिका के रूप में प्रकाशित किये जाने का निर्णय लिया गया है। इसके लिए हिन्दी में वैज्ञानिक एवं तकनीकी साहित्य के सभी लेखकों, सम्पादकों, अनुवादकों, प्रकाशकों तथा संस्थानों आदि से निवेदन है कि वे 1981 से 1990 की अवधि में प्रकाशित अपनी पुस्तकों/पत्रिकाओं का निम्न विवरण नीचे लिखे पते पर शीघ्र भेजने की कृपा करें।

**प्रकाशन का विवरण :** 1. पुस्तक/पत्रिका का नाम, 2. लेखक/संपादक का नाम एवं पता, 3. यदि पुस्तक अनुदित है तो मूल लेखक एवं अनुवादक का नाम एवं पता, 4. प्रकाशक का नाम एवं पता, 5. प्रकाशन वर्ष, 6. संस्करण, 7. पृष्ठ संख्या, 8. मूल्य।

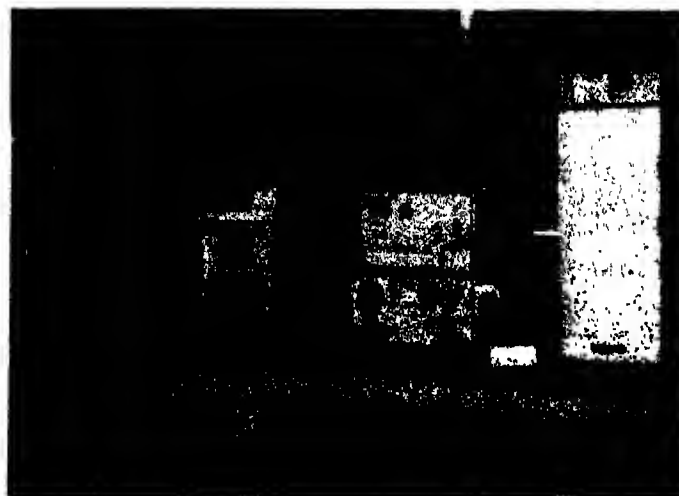
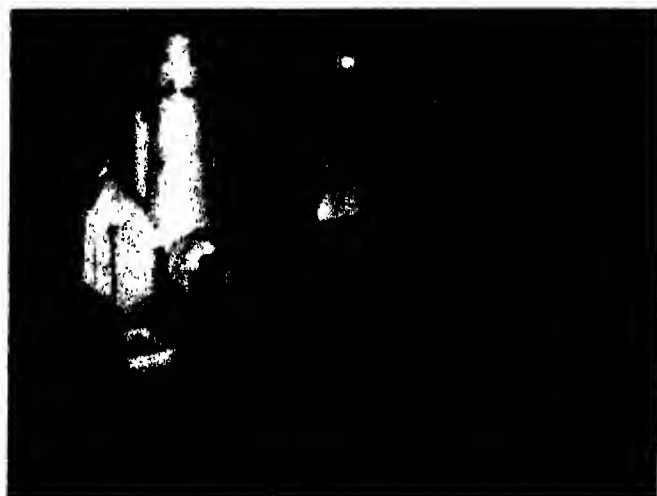
**भेजने का पता :** तुरजन पाल पाठक, सम्पादक, हिन्दी वैज्ञानिक एवं तकनीकी प्रकाशन निदेशिका 1981-1990, प्रकाशन एवं सूचना निदेशालय (सी.एस.आई.आर.), हिलसाइड रोड, पूसा गेट, नई दिल्ली-110012.

# CSIR NEWS



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► Some of the sophisticated instruments at the Central Facility for Physico-chemical Measurements and Characterization at CECRI (clockwise from top left) : Scanning Electron Microscope, Gel Permeation Chromatograph, X-ray Powder Diffractometer and CHN Elemental Analyzer (p.266).

## Science in India : Prospect and Retrospect

A conference on 'Science in India : Prospect and Retrospect' was held at the Indian Institute of Chemical Biology, Calcutta, during 29 September - 1 October 1991, to take stock of the achievements and failures of science in India. The main thrust of the conference, second in the series of lead conferences being organized as a part of the CSIR Golden Jubilee Celebrations, was to look ahead in science and to see what we can best do with the facilities already existing and those which we hope to have in the near future. The topics chosen were those where India already has a technological advantage, and with a little effort could make far reaching breakthroughs. The frontier areas identified included materials science, petrochemicals technology, aerospace sciences, silicon technology, ocean sciences, radio astronomy, atmospheric science, vaccines, and nuclear energy, among others.

The highlight of the conference was the large participation by young scientists. This provided an opportunity for an active interaction between the young and the old. Leading scientists from various fields presented their work in a very lucid manner, giving the participants an opportunity for the development of a strong inter-disciplinary research effort in the near future.

High temperature superconductivity and nano-materials were the thrust areas highlighted in the talk given by Dr S.K. Joshi, Director General, CSIR. Dr P. Rama Rao, Secretary, Department of Science and Technology, dwelt on the challenges in application of new materials. He said that a lot of stress should now be on downstream processing, and new materials should be developed with

the end user in sight. Dr B.K. Sarkar, Director, Central Glass & Ceramic Research Institute, Calcutta, who spoke about advanced ceramics, lamented that the right kind of raw materials to produce novel ceramics are not available in India. He said ceramics can play a very important role in cutting tool applications.

Dr R.A. Mashelkar, Director, National Chemical Laboratory (NCL), Pune, said that Chemical Engineering will be the centre of attraction in the coming years. Petrochemicals was another hot topic of discussion, with Dr Paul Ratnasamy of NCL highlighting the need for import substitution. He spoke at length on how natural gas can be converted to diesel and kerosene and described how cane sugar could act as a precursor molecule for various petrochemicals.

Dr R. Narasimha, Director, National Aeronautical Laboratory, Bangalore, threw light on the efforts being made in India to design and develop our own aircrafts using latest materials like carbon fibre composites.

A cost effective electric vehicle should be a reality said Dr S.K. Rangarajan, Director, Central Electrochemical Research Institute, Karaikudi. He spoke at length about the role electrochemistry (essentially rechargeable batteries) can play in providing a clean energy source.

Dr Govind Swarup of the Tata Institute of Fundamental Research, Bombay, disclosed that very soon we will have a functional Giant Metre Wave Radio Telescope near Pune, which will be the largest and finest telescope anywhere in the world.

In a scintillating presentation, Dr K. Kasturirangan, Director,

ISRO Satellite Centre, Bangalore, spoke about the indigenous efforts being made to make deep roads into the realm of satellites and their applications. He informed that the Stretched Rohini Series of Satellites will carry payloads to explore 'gamma ray bursts', which have till now eluded a satisfactory scientific explanation.

Speaking on 'changing concepts in atmospheric environment', Dr A.P. Mitra, CSIR Bhatnagar Fellow, said it is not easy to understand the chemistry of the upper atmosphere, but to mitigate the problem of ozone depletion and greenhouse effect, a better understanding is necessary. A national facility in the form of the world's largest 'Mesosphere, Stratosphere, Troposphere Radar' (MST Radar) is coming up near Tirupati in Andhra Pradesh to study the atmosphere, Dr Mitra added.

Vaccines were the topic of discussion by Dr J. Das of the Indian Institute of Chemical Biology, Calcutta. He highlighted that the development of vaccines for parasitic diseases is not an easy task and is posing many biotechnological challenges for the Indian scientists.

A short but informative exhibition was also put up at the venue by the National Council for Science Museums, highlighting the achievements made by CSIR. The key attraction was the live demonstration of the phenomenon of magnetic levitation of a ceramic superconductor.

It was a common feeling amongst the participants that a whole hearted effort should be made to develop a good marketing strategy for the indigenous technologies and the focus should be to develop competitive technologies keeping in mind the rapidly changing world scenario. □



# NATIONAL PHYSICAL LABORATORY, NEW DELHI

## R&D Highlights : 1990-91

The National Physical Laboratory (NPL), New Delhi, during 1990-91, actively contributed to the National Scientific and Technological Programmes : (i) SROSS Aeronomy Satellite, (ii) Superconductivity, (iii) International Geosphere-Biosphere Programme and (iv) Standardization, Metrology and Quality System.

R&D work was also carried out in the following CSIR mission programmes : (i) New Materials, (ii) Microelectronics, and (iii) Advanced Ceramics. Laboratory thrust area programmes included : (i) Characterization of Materials; (ii) Amorphous and Crystalline Silicon and (iii) Modern Communication Systems-Media Characterization.

In the area of Standards and Metrology, efforts were continued to improve levels of accuracy in measurements on base units as well as derived units. The laboratory participated in international intercomparisons in several areas. Calibration and testing facilities were provided to users in various sectors.

The laboratory continued to coordinate calibration activities in the country under the NCTCF programme. Two units of methane-stabilized He-Ne lasers were developed with frequency stability of a few parts in  $10^{11}$ . Volume of a solid glass cylinder was established in terms of density of water with an uncertainty of a few parts per million. In the case of pressure standard, results of international intercomparison involving five laboratories including NPL, showed agreement within  $140 \times 10^{-6}$  in the measurements of effective area at zero pressure. Calibration of standard condenser microphones was carried out jointly with VNIIFTRI- USSR.

Transfer standard of single power phase ac power and energy was realized in terms of dc voltage and current standards. In collaboration with VNIIM-USSR, intercomparisons of 10 pF silica and 1 nF - 100 nF mica capacitance standards were carried out.

Fundamental as well as applied research was continued on high temperature superconductors. Basic investigations on La-214, Bi-212 and Y-123 systems were concerned with introduction of selected rare-earth and 3d transition metal ions into these and their effect on superconducting properties. A superconducting magnet for separation of ores and other materials was successfully developed and tested in close association with BHEL. It was designed to produce a maximum field of 5T in a room temperature bore of 100 mm. Preparation and studies of thick and thin films as well as tapes of high Tc materials were continued by using a variety of techniques. Rf SQUIDS based on thick films of YBaCuO and BiSrCa-CuO systems were developed and operated in flux locked loop mode which enabled measurement of flux values ranging from a fraction of a flux quantum to several flux quanta with same high sensitivity. Coulomb interaction in cuprates was studied on the basis of a time dependent multiple scattering theory.

Research and development work on electronic and engineering materials was continued. A single crystal silicon solar cell with 13.5% efficiency was fabricated. Two thin film amorphous silicon solar cells could be combined in tandem and the efficiency of the structure could be increased by optimization of film thickness. A total internal microoptic switch using high-tilt-

angle materials was developed for photonics applications. Conducting polymers, leucomeraldine and pernigraniline were prepared. A systematic study helped in reduction of time taken for pyrolysis of stabilized fibres. For development of oxidation resistant ceramics, silica and silica based materials were synthesized by sol-gel process in collaboration with IIT, Delhi.

An NPL-DOE Centre for Characterization of Materials for Electronics became functional, which provides service, undertakes consultancy assignments, trains manpower and carries out fundamental research. Significant research investigations include study of electronic and structural defects generated by implantation in silicon crystals relevant to shallow junction formation, structural studies of high Tc superconductors, study of biaxial stress at the interface of GaAs substrates with multilevel metallizations and investigation of methane emission from paddy fields. A five-crystal X-ray diffractometer was developed in the laboratory with state-of-the art level resolution. Single crystals of lithium niobate were grown on a system developed in NPL. Three Indian Reference Materials (Bharatiya Nirdeshak Dravayas) prepared through a joint effort of seven laboratories were released and supplied to users.

The Radio Science Group contributed significantly to nationally coordinated and laboratory projects. Under the IGBP, UV-B radiation received at the ground in 1991 was found to be less than that observed in the preceding three years even though there was appreciable increase in ozone level. Flight packages of the sensors and electronic hardware for the payloads for SROSS were space

qualified. A new computerized method for predicting sun spot cycle was developed and tested. High solar activity during the year caused disturbances for communications and ARWC issued several special warnings to the agencies. An acoustic sounding system was developed in collaboration with the SV University and IIT-Kanpur. Detailed comparison was made of neutral atmosphere, ionosphere and solar wind interaction of Venus and Mars.

Collaborative research with several R&D institutions, universities and scientific departments

was continued. These include BHEL, ISRO, DST, DOE, DOD, CEL and CEERI. The amount realized from other agencies for the sponsored projects during the year was over Rs 23 million. Consultancy services were provided to the government departments and industry in the areas of acoustic treatment, materials characterization and instrumentation. The processes for preparation of TV picture tube phosphors, rear view prisms for aircraft, glassy carbon and oxidized PAN fibre were released to the industry for the first time.

Professor J.N.Thomas, Director, The Royal Institution of Great Britain, delivered Krishnar Memorial Lecture on 'The Genius of Michael Faraday'. A number of distinguished scientists from India and abroad visited the laboratory and delivered lectures. They included Prof. G.B.Donaldson, Sir Herman Bondi, Dr T.Spurling, Prof. Markl Habert, Dr U.R.Rao, Prof. Theodor Berchem and Dr S.Z.Qasim. About 140 papers were published in national and international journals and 10 research reports were produced. □

## **NATIONAL AERONAUTICAL LABORATORY, BANGALORE**

### **R & D Highlights : 1990 - 91**

The National Aeronautical Laboratory (NAL), Bangalore, continued to pursue the two civil aircraft design and development projects. For the NAL Light Aircraft (NALJA), a two-seater which would serve as a trainer, negotiations with an industrial partner were in an advanced stage; work on design was started and test parts were being fabricated. A detailed feasibility report was completed for the Light Transport Aircraft (LTA). This aircraft is expected to fill multiple roles, including those of a six-passenger executive aircraft, a 9-14 passenger commuter/air taxi and air ambulance and other services.

The Systems Engineering Division of the laboratory was split into three divisions devoted to: Aerospace Electronics and Systems, Flight Mechanics and Controls, and Flight Experiments.

The major objective of the Aerospace Electronics and Systems Division is to assist the both Defence and Civil Aviation sectors through R & D in subsystem hardware for flight controls such as

sensor technology, fault tolerant computers and expert systems and in telemetry and digital signal processing and atmospheric studies relevant to aviation. The Division has already made a significant contribution to 'Black Box' readout systems for civil aircraft, and is developing as a centre for related R & D. For the court of inquiry into the A320 aircraft accident that occurred in Bangalore on 14 February 1990, the Division undertook a critical analysis of the cockpit voice recorder data of the ill-fated aircraft. A transcription of the signals from the digital flight data recorder installed on a VVIP aircraft was provided to Indian Airlines. The design of a prototype model of a flow angle sensor was completed. An instrumented mast was being installed near Bangalore airport to capture and study special atmospheric events of interest in aviation. The Acoustic Test Facility was extensively used for several tests involving INSAT- II, and assistance was rendered to DRDL in finalizing the acceptance test plan for its own facility.

The Flight Mechanics and Controls Division will investigate all problems relating to the stability, dynamics, control and performance of aerospace vehicles, applying the principles of fluid and solid mechanics, mathematical modelling (including parameter estimation/identification), modern/classical control theory, and real time simulation with appropriate experimental validation. An NAL project on parameter estimation, with the participation of the Aeronautical Systems and Testing Establishment (who carried out flight tests), ADA and HAL, was completed with very satisfactory results. Similar techniques have also been used for analyzing trajectories in the aeroballistic range at DRDL, Hyderabad, and the results from the first flight of the Prithvi missile. A linearizing link software called ALLS was fully validated. This package utilizes wind tunnel or other data base on any given aircraft to determine trim conditions in steady flight from a nonlinear aircraft model (including straight and level, level turn, thrust stabilized turn, push-over/pull-

up, constant side slip), and further generates linear state-variable models about these trim conditions. It provides a powerful tool for both flight control design and aircraft performance optimization. The Division began major programmes on the development of a get-home control law for the LCA, aeroservoelasticity, and handling qualities research. Some of the expertise developed in the latter area was used to predict the handling qualities of the HS-748 aircraft with a rotodome for the ASWAC project.

The objective of the Flight Experiments Division is to : (a) conduct flight experiments and research to support the laboratory's R & D programmes, particularly when flight experiments are the most appropriate means of developing a new technology, and demonstrating its capabilities, (b) develop the capability of designing and fabricating manned and unmanned scaled aircraft to generate flight data for future aircraft projects, or experimental aircraft to meet special requirements, and (c) support flight-related activities in India. The Division is deeply involved in the NALLA project. During last year, several modifications were made to the laboratory's Light Canard Research Aircraft, including installation of wheel fairings and an autopilot, and flight data were acquired for determination of longitudinal stability derivatives.

The Computational and Theoretical Fluid Dynamics Division followed up the earlier experimental study of anomalous temperature jumps and gradients in liquid-vapour phase change by a detailed theoretical investigation of the gas dynamics of phase change, which shows an unexpectedly large influence of viscosity and non-linearity on the phenomenon. A 3D

Euler code was completed and delivered to the Aeronautical Development Agency. An exercise carried out as part of a joint project sponsored by the Commonwealth Aeronautical Advisory Research Council, involving the comparison of the prediction of computer codes developed in different Commonwealth laboratories with careful experimental data, led to considerable improvements in NAL's full potential code for predicting aerofoil characteristics. A 16 processor parallel computer (Flosolver Mk 2) is now in operation in the laboratory. An exercise carried out with the Suprenum in Germany demonstrated the portability of NAL parallel codes. A panel code was parallelized, enabling the laboratory to handle the computer 3D flow problems involving nearly ten thousand panels.

The Experimental Aerodynamics Division continued to provide aerodynamic design data to various national projects, including LCA and various missiles for Defence, and the ASLV and PSLV for Space. A captive trajectory system was installed in the H1 tunnel (1.2m), and the laboratory is now in a position to undertake detailed studies of stores trajectories released from aircraft. Using a new control system for forced-oscillation tests, dynamic derivatives have been obtained at supersonic speeds. Research programmes in the Division are concentrating on flow structure and management, especially in the technologically important areas of base and friction drag reduction.

In the Materials Science Division, a conducting paint was developed for obtaining high radar reflectivity (required for antennas and for measurement of radar cross-section of FRP models). Under the Integrated Long-term Programme of Cooperation in S & T between NAL and the Institute of

Physics-Sun, Tashkent, in the area of solar energy, panels suitable for the collector to be used with the solar pump developed by the Tashkent Institute, were black chromium plated and sent to Tashkent. An improved version of AVRA was demonstrated at the Indira Gandhi International Airport, New Delhi.

The Propulsion Division continued to give R & D support to the indigenous gas turbine aeroengine Kaveri being developed at the Gas Turbine Research Establishment. Projects of the Division have included high pressure turbine blading, the combustion chamber and the afterburner system; the work has often involved use of the computational and experimental tools developed in the Division.

In the Structural Sciences Division, the final phase of ground vibration testing was completed on the AEW version of the HS-748 aircraft, with inertia simulation of the rotodome and with the rotodome actually installed. The project has now been extended to cover flight vibration tests as well. A carbon fibre reinforced plastic (CFRP) wing box to test the proposed lightning protection scheme for the LCA wing was fabricated. A 3D finite element package with adaptive mesh refinement was developed on the lines of an expert system. This package is being used in the design of the NAL civil aircraft programmes. A method for predicting crack growth rate for different maximum stress levels was developed and found to give good correlation with experiments. A simplified engineering approach to crack growth prediction under spectrum loading was also developed.

Under the Wind Energy Programme, studies on wind velocity data were continued at two locations in Kappatagudda which is now confirmed as the windiest

site so far discovered in the country. Proposals have been made for erecting suitable wind farms on these sites.

The CSIR Centre for Mathematical Modelling and Computer Simulation (C-MMACS) carried out a number of modelling studies in collaboration with other CSIR laboratories and government departments, notably in the area of ocean modelling. C-MMACS now also functions as a cell of the Department of Ocean Development to develop pollution modelling methodologies. The computing facilities at the Centre have been enhanced; new software has been acquired, including the IMSL package for numerical analysis and the expert system shell NEXPERT. The hardware additions include two new workstations. The COSMOS 486 system has also been upgraded.

A technology transfer agreement was signed with a private company for commercial production of ferromagnetic chromium dioxide powders through a novel process developed in the Materials Science Division. The powder is suitable for making magnetic recording tapes for audio, video, instrumentation and computer applications. This product should be superior to the gamma ferric oxide presently being employed for such applications in the country.

Complete process knowhow for descaling of diesel loco-engine components was transferred under a licence agreement signed recently. This is the second licence to be issued for this knowhow. Technology for the manufacture of corrosion rate monitors was also transferred. High precision load cells developed in the Aerospace Electronics and Systems Division were licensed through NRDC. The technology transfer for foil type strain gauges, developed in the Materials and Aerospace

Electronics Divisions was completed. A collaborative research agreement was signed with a private company for upgradation and commercialization of a gas turbine cogeneration plant developed earlier by NAL to utilize sludge gas from the K & C Valley Sewage Treatment Plant. A major consultancy programme for US Corpora-

tion working for NASA Langley was awarded to a senior scientist of the laboratory; the first phase of the work was successfully completed!

During 1990-91, 72 papers were published in various national and international journals, and 68 papers were presented in symposia/seminars. □

## Central Facility for Physico-chemical Measurements and Characterization at CECRI

The Central Electrochemical Research Institute (CECRI), Karaikudi, has set up a Central facility housing nine major instruments for physico-chemical measurements and characterization.

Inaugurated by Dr A.P. Mitra, FRS, former Director General, CSIR, on 10 May 1991, the facility has: (1) Scanning Electron Microscope (JEOL Model), (2) X-ray powder diffractometer (JEOL Model JDX 8030), (3) Atomic Adsorption Spectrophotometer (Perkin Elmer), (4) IR Spectrophotometer (Perkin Elmer), (5) UV-VIS-NIR Spectrophotometer (Hitachi), (6) Gas Chromatographic Analyzer (Perkin Elmer), (7) High-performance Liquid Chromatograph (Shimadzu, Japan), (8) Gel Permeation Chromatograph (Shimadzu), (9) Elemental Analyzer (Heraeus, Germany). The special features of these instruments/equipment are:

1. *Scanning Electron Microscope:* It is a versatile model with a resolution of 60 Å and a maximum magnification of 1,80,000 times. Surface analysis/chemical analysis can be carried out by this instrument. It has facilities to form images with secondary electron detector, backscattered electron detector and absorbed electron detector for doing surface analysis. Cathodoluminescence detector is attached with this unit, which is very useful for analyzing picture

tube phosphor materials. The wavelength dispersive spectrometer attached with this instrument is used for Electron Probe Micro Analysis (EPMA). EPMA is a powerful technique for both qualitative and quantitative elemental analysis. The SEM micrograph reveals all sorts of informations on surface structure, composition and topography.

2. *X-ray Powder Diffractometer:* The instrument is useful for identification/characterization of polycrystalline materials. It has 'Peak Search' and 'Search Match' software provisions. The XRD System can also be used for determination of thin film thickness, residual stress measurements and phase transformation studies.

3. *Atomic Absorption Spectrophotometer:* The instrument is used to measure the degree of absorbance by atoms from incident energy at discrete wavelengths. Metallic concentrations in any aliquot can be determined at microgram levels within seconds with built-in microprocessor facility. About 65 metals can be analyzed by this instrument.

4. *Infra-red Spectrophotometer:* It is a versatile equipment for a rapid identification of organic functional groups and other trace organic impurities present in any solution. It covers a range between 4000  $\text{cm}^{-1}$  and 600  $\text{cm}^{-1}$ . It can store standard

spectra which can be recalled at the time of matching with those of the unknown samples.

**5. UV-VIS-NIR Spectrophotometer.** It is widely used for the optical characterization of various organic and inorganic species in transmittance/absorbance mode. The special feature of this instrument (range 185-2600 nm) is the facility to carry out diffuse reflectance studies useful for the characterization of powdered samples, pellets, coarse/polished surfaces and coatings.

**6. Gas Chromatographic Analyzer.** The equipment is filled with a single injector and a single detector (FID). Nitrogen gas is used as a carrier gas. GC is suitable for substances which are volatile without decomposition around 450°C. This equipment is mainly used for a complete analysis of organic liquids.

**7. High-performance Liquid Chromatograph:** The equipment is fitted with LC-8A pump, UV and RI detector and CLC-ODS column. Organic compounds are separated depending on the adsorbability on the solid support in the column when liquid mobile phase is passed through the column. Trace impurities in organic mixtures can be detected.

**8. Gel Permeation Chromatograph:** The GPC has RI detector with styragel column. Depending on the molecular size, the separation of the compound takes place. This facility is mainly used for the analysis of polymer composites, molecular weight distribution and the stereo-chemistry of polymers.

**9. Elemental Analyzer.** It is a multi-function analyzer for the determination of elements and in solids and liquids has wide range of sample weight choice from 0.2 to 200 mg.

The facilities are being extensively used by the research staff of the institute, research students and also by outside colleges, universities and other private agencies.

## Rotary Viscometer for Sugar Industry

The Madras Unit of the Central Electronics Engineering Research Institute (CEERI), has developed a microprocessor-based rotary viscometer which enables real-time monitoring and controlling viscosity/consistency of massecuite in the sugar industry. This helps to find the most suitable level of super saturation for seeding, and also fixes the exact time at which the centrifuging process has to be initiated for obtaining sugar crystals of good quality. Besides the control of viscosity/consistency it helps to reduce the sugar losses in molasses.

Technical specifications of the viscometer are as follows:

System design:	Z-80 Micro-processor based
Sensor:	Single rotating drum
Measurement:	On-line
Display:	Digital, 4 digits
Display mode:	Set and read
Range:	(i) 0.1 Pa. s - 1 Pa. s (ii) 1 Pa. s - 100 Pa. s
Accuracy:	± 1.0% f.s.d
Repeatability:	Better than 0.5%
Resolution:	0.01 Pa. s
Output current:	4-20 mA
Output voltage for alarm:	5 V or 0 V
Power supply:	230 V, 50 Hz, Stabilized

## Mechanisms regulating collagen synthesis and gene expression

In the last few months significant contributions have been made at the Central Leather Research Institute (CLRI), Madras, towards the understanding of the mechanisms that regulate collagen synthesis and gene expression, and the role of collagen post-translational modifications with special reference to non-enzymatic glycosylation. A novel culture technique has



Rotary viscometer for sugar industry

been developed for the culture and passage of adult human epidermal cells.

### ***Stimulation of collagen synthesis in fibroblast cultures by superoxide***

Several studies suggest a role of oxygen and its metabolites in the regulation of collagen synthesis. Inflammation is a patho-biological condition characterized by the generation of superoxide from radical oxygen leading to excess collagen synthesis and deposition in tissues. The synthesis of collagen during wound repair is modulated by the availability of oxygen. Agents such as bleomycin and paraquat, which generate  $O_2$ , also stimulate collagen synthesis. Because of the importance of inflammation in fibrotic disease, it is of interest to examine the mechanisms involved in the stimulation of collagen synthesis under these conditions. An investigation on the synthesis of collagen in the presence of exogenous superoxide in human fibroblast has been carried out. Exposure of fibroblasts to superoxide generated by dihydroxyformate resulted in increased collagen synthesis. The synthesis of type III collagen was stimulated to a greater extent than the synthesis of type I collagen. The stimulation of collagen synthesis was abolished by superoxide dismutase. These observations suggest that superoxide may play a role in the regulation of collagen synthesis and it may modulate differential collagen gene expression. These observations may also explain the increased synthesis of collagen in tissues following inflammation or exposure to oxidant conditions.

### ***Culture of adult-human epidermal cells and basement membrane synthesis***

Although much progress has been made in defining growth conditions

of adult human keratinocytes, cultured keratinocytes exhibit only part of the differentiation process seen in vivo and serial passage of adult human keratinocytes is difficult. Recently, a culture system was developed at CLRI that permits the maintenance and subculture of adult human epidermal keratinocytes over prolonged periods, in the absence of dermal substrates. These cells elaborate a basement membrane like extracellular matrix and continue to exhibit morphological and biochemical characteristics of keratinocytes. These cultures synthesized all four classes of keratins associated with keratinocyte differentiation.

### ***Post translational modifications — the role of non-enzymatic glycosylation***

The modifications of diabetic and ageing collagen are attributed to the browning reaction that occurs as a consequence of non-enzymatic glycosylation (NEG). In order to delineate the mechanisms by which NEG brings about disturbances in collagen metabolism, the influence of *in vitro* NEG on the crosslinking, fibrillogenesis and some physico-chemical parameters of type I collagen was examined. These cells indicated that NEG induces structural and functional changes in collagen. □

## **Culture of live feed for shrimps**

During 1990, India's marine products export touched Rs 9000 million, of which 70% accounted for shrimp export. Since production of shrimps from fishing ground by boats and trawlers is stagnating, coastal aquaculture is considered as an alternative source for increasing shrimp exports. The Government of India has identified nearly 1.4 million hectares of

brackish water area as suitable for shrimp cultivation. In order to popularize and to encourage private farmers and entrepreneurs in shrimp culture, India has set up two large hatcheries in Orissa (OSSPARC) and Andhra Pradesh (TASPARC), each capable of producing 20 million post-larvae of shrimp. In addition to these two hatcheries, there are many private hatcheries (TOMCO, Hindustan Lever Ltd, Deejay, Pioneer Aquafarms, etc.) spread along the coasts of Andhra, Tamilnadu, Kerala and Karnataka.

One of the major requisites for the successful operation of these hatcheries is the provision of a suitable live feed for the developing stages of the shrimp, especially the mysids and post-larvae. Culturing of natural food such as zooplankton for fish and shrimp larvae is either commercially unfeasible or technically hard to realize.

During the thirties, it was discovered in USA and Norway that the 0.4 mm nauplius larva of the brine shrimp, *Artemia* constitutes an excellent food source for new born fish and shrimp larvae. The advantage of using *Artemia* is that one can produce an 'instant live feed' on demand from the inactive dry cysts which can be stored for years and only have to be incubated for 24 hrs in seawater to produce free swimming larvae.

The annual world consumption of *Artemia* cysts rose from 40 tonnes in seventies to 200 tonnes in late eighties. With the increase in the aquaculture activities around the world, the demand for the cysts exceeds the present supply. Till recently, the Indian shrimp hatcheries were importing these cysts from USA at a price ranging from Rs 1500 to 2000 per kilogram. The average annual requirement of each of these hatcheries is around 500 kg. Uncertainty in the supply



and the high cost of importing the cysts made several scientists in India and abroad to take up *Artemia* culture in solar salt pans and saline lakes which are the natural habitats of *Artemia*.

The National Institute of Oceanography (NIO), Goa, initiated R & D work in 1975 on the brine shrimp *Artemia* and its culture potential in India. Baseline information on the culture aspects was collected from both the laboratory and field studies which revealed that the Indian strain of *Artemia* is parthenogenetic (only female *Artemia* in the population). It was further observed that the cysts have a maximum hatching at 35‰ salinity and at a temperature of 30°C. Biochemical estimations showed that the nauplii (larvae) of *Artemia* have 60% protein, 24% lipid, 13% carbohydrate and 3% ash. Studies on the natural population of *Artemia* showed that they prefer a threshold salinity of 100‰ as a protective mechanism against predators which otherwise are found upto 90‰. At this salinity level, the reproduction was ovoviviparous (production of young ones) and each *Artemia* released about 100 nauplii once in five days. At a higher salinity of 140‰ and above, *Artemia* switched over to oviparous mode of reproduction (cyst production) wherein encysted cysts (eggs) were released. This is an adaptation to tide over the adverse environmental conditions such as high salinity (>140‰), temperature (>35°C) and low oxygen (2 ml/l). The cyst production from natural population was estimated as 30 kg/ha/4 months season.

After having collected all relevant information from both laboratory and field studies, trials on a pilot scale were carried out in the salt pans at Mundra, Gujarat, under a project sponsored by the Bharat Salt and Chemical In-

dustries, Bombay. Cyst production of 30 kg/ha/4 months season was obtained. This was the first successful trial culture of *Artemia* in India. Subsequently, the culture technology developed at NIO was transferred to the Government of Sri Lanka, under the Indo-Sri Lanka bilateral programme. Some time back, Ballarpur Industries Ltd (Thapar Group), New Delhi, sought the technical assistance of NIO for culturing *Artemia* for the production of cysts at their salt production unit in Singach, near Jamnagar, Gujarat, through a sponsored research project. One of the best *Artemia* strains, viz. San Francisco Bay strain, which is used world wide for its small sized cysts (229 micron) and high levels of highly unsaturated fatty acid (HUFA) contents (27 mg/g), was introduced and cultured successfully. With a production period of eight months in two years, 700 kg of dry cysts were harvested from a 25 ha pond. The cysts were immediately processed and are now being sold by the Ballarpur Industries Ltd to major shrimp hatcheries in India, under the brand name 'SUNSHINE'.

The Ballarpur Industries Ltd have drawn up ambitious plans to develop *Artemia* culture in a 500 ha area to produce cysts on a large commercial scale under technical collaboration with NIO. A fee of Rs 5 lakh has already been paid to NIO. In addition to this, the company has agreed to pay a royalty of 3% on annual sales for a period of seven years. With the commercialization of this product for the first time in India, all hatcheries in the country are now assured of a reliable source to meet their *Artemia* cyst requirement. This would save a substantial amount of foreign exchange spent on importing this product.

*Artemia* culture is relatively simple and cost effective and can

be taken up by small farmers and salt manufacturers in salt production centres which are spread all along the Indian coastline. □

## Biological uptake of carbon dioxide by the oceans

Annually about 6000 million tonnes of CO<sub>2</sub> is released from man-made sources. But its present accumulation rate of approximately 1 ppm in the atmosphere and the rates of its uptake by land and ocean biota suggest that only half of what is released ends up in the atmosphere. Although it is being increasingly recognized that the oceans are a possible sink for man-made CO<sub>2</sub>, the complex physico-chemical and biological processes that control the uptake of CO<sub>2</sub> by the oceans are still poorly understood.

Microscopic plants in the sea fix atmospheric CO<sub>2</sub> during photosynthesis and thus effect its transfer to the upper ocean from the atmosphere. On their death and decay, a part sinks down to the abyss of the ocean carrying with it the CO<sub>2</sub> removed from the atmosphere. From the point of view of CO<sub>2</sub>, it is this part which is important, since it gets stored away in the deep sea water column or in the deep sea sediments. Variations in the quantity so removed determine to a large extent the fluctuations in the CO<sub>2</sub> content in the atmosphere in the short or long term.

Since 1986, scientists from the National Institute of Oceanography (NIO), Goa, and the University of Hamburg in Germany have been conducting experiments in the northern Indian Ocean in order to assess the biological uptake of CO<sub>2</sub> by the oceans. Sponsored by CSIR and the Federal German Ministry of Science and Technology, the study involves use of the devices

called 'sediment traps'. These traps when deployed at various depths in the ocean collect at preprogrammed time intervals the carbon-containing particles settling to the deep sea.

The results show that the monsoons have a strong impact on the removal of CO<sub>2</sub> from the atmosphere. Stronger the monsoon, more is the CO<sub>2</sub> removed. However, the mechanisms which induce this increased uptake differ. In the Arabian Sea, winds and windblown dust induce this uptake whereas in the Bay of Bengal, it is the discharge from the major rivers such

as the Ganges and Brahmaputra, which controls the uptake.

Inherent in the observed coupling between atmospheric processes orchestrated by land masses and the CO<sub>2</sub> removal processes in the ocean, is a warning that continued CO<sub>2</sub> emissions and global warming will inevitably lead to an amplification of the adverse effects which are already being detected. The change in atmospheric circulation pattern expected from global temperature changes (e.g. a weak monsoon) or any reduction in the river discharge will interfere negatively with CO<sub>2</sub> removal processes in the sea.

### **Entrepreneurship Development Programme on Fibreglass Reinforced Plastics**

A six-week Entrepreneurship Development Programme on Fibreglass Reinforced Plastics was held at the Central Glass and Ceramic Research Institute (CGCRI), Calcutta, from 29 April to 7 June 1991 under the sponsorship of DST, and S&T Departments, Government of West Bengal, in collaboration with WEBCON Ltd, Calcutta. CGCRI had earlier conducted nine such short training programmes on FRP Technology with theoretical and practical classes. About 17 persons have already started production of FRP and its allied products in small scale. This is the first time that CGCRI has conducted a six-week EDP on FRP as per guidelines of DST. The inaugural function was held on 29 April.

Prof. Dilip Kumar Basu, Secretary, S&T Department, Government of West Bengal, was the Guest of Honour and Shri D.K. Roy, President, Bengal National Chamber of Commerce & Industries, Calcutta, was the Chief Guest. Dr B.K. Sarkar, Director, CGCRI, in his welcome address

highlighted the importance of EDP on FRP Technology and advised the trainees to contact the institute for any technical assistance on starting their units. Shri Roy, in his address, highly appreciated this type of product oriented programmes and asked the trainees to take full advantage of the training programme. Prof. Basu suggested that such type of product-oriented EDPs on the processes developed in CSIR laboratories should be conducted frequently.

The management part of the course such as entrepreneurial qualities, achievement motivation, financial management, production and marketing management, project report preparation, registration formalities with DIC, loan facilities from different banks and financial organizations, etc. was conducted in collaboration with WEBCON Ltd. CGCRI imparted training on the theoretical aspects of FRP technology. The course included demonstration of the preparation of different FRP products. Arrangements were also

made for the trainees to visit two FRP factories. □

### **TRAINING COURSES**

#### **Fourth Training Programme on Large Scale Cultivation & Distillation of Aromatic Plants**

The Regional Research Laboratory (RRL), Bhubaneswar, organized the fourth training programme on Large Scale Cultivation and Distillation of Aromatic Plants (palmarosa, lemongrass and citronella) during 5-8 August 1991.

The programme was organized mainly to train trainers for popularizing large scale cultivation of aromatic plants under the Action Plan 'Training of trainers for a variety of vocational trades in rural areas' of CSIR. The training covered lectures and field demonstrations on various aspects of cultivation practices from nursery sowing to harvesting of palmarosa, lemongrass and citronella, the three most promising crops of aromatic plants for the region and distillation, packing, storing, quality evaluation and marketing of their oils. The programme was attended by 47 persons from Orissa and Madhya Pradesh. □

#### **CSMCRI, Training Programmes on Quality Control of Iodized Salt**

The Central Salt & Marine Chemicals Research Institute (CSMCRI), Bhavnagar, organized two training programmes, one each in January 1990 and June 1991, for the benefit of laboratory technicians working in the Health Centres of the Gujarat State Health Department. The laboratory technicians of Health Centres of Valod, Bharuch, Surat, Baroda, Amreli, Panchmahal, Sabarkantha and Dang districts were trained in quality control of

iodized salt. The training consisted mainly of theory lectures on chemical analysis of salt, iodine in iodized salt and salt iodization process. The trainees were explained submission process of iodization of salt, for estimation of calcium, magnesium, chloride in common salt. □

## Honours & Awards

### Dr B.M. Reddy elected fellow of INSA

Dr B.M. Reddy, Head, Radio Science Division, National Physical Laboratory, New Delhi, has been elected Fellow of the Indian National Science Academy, w.e.f. 1 Jan. 1992, in recognition of his eminence in the area of Atmospheric and Space Sciences.

Dr Reddy was the first to describe the thermal structure of the topside ionosphere from satellite *in situ* observations and to identify the day - time latitudinal trough in electron density distribution (during his post-doctoral tenure at a NASA centre in USA, 1964-67).

He proved conclusively that the topside electron densities increase considerably during all phases of the magnetic storms, and his thermal expansion theory has been confirmed subsequently by several workers. His contributions in the area of ionosphere-magnetosphere interactions, polar wind and related magnetospheric dynamics have been outstanding. In recognition, he was honoured with the Vikram Sarabhai Award for Space Sciences for the year 1975.

Dr Reddy's work on the equatorial ionosphere including scintillations, generation of irregularities and their effects on radio and radar propagation was both extensive and intensive. In recognition, he was invited to par-

ticipate in the NASA Space Shuttle SIR-B investigation in 1983. Dr Reddy pioneered Tropical Radio Communications in India along with Dr A.P. Mitra at NPL. He is one of the chief architects of the URSI Handbook on Radio Propagation, edited by Dr A.P. Mitra, B.M. Reddy, S.M. Radicella, J.O. Oyino and S.Feng.

The group led by him at NPL has excelled in all areas of radio propagation in the atmosphere and he has initiated a whole new series of experiments to study ozone and other greenhouse gases. □

## ANNOUNCEMENTS

The Structural Engineering Research Centre (SERC), Madras, is organizing the following courses during January 1992 at SERC, Madras:

### 1. Advanced Course on Analysis, Design and Construction of Natural Draught Hyperboloid Cooling Towers (NDCTs) (8-10 January 1992)

NDCTs are being widely used in thermal and nuclear power industries. Over the past decade SERC, Madras has done a lot of R&D work on the analysis and design of NDCTs. The main objective of the course is to provide exposure to the participants on the latest techniques/procedures for analysis, design and construction of NDCTs. The course is also intended to identify the needs of the cooling tower industry for improvements in structural design and construction of NDCTs involving R&D efforts. The participants will also be exposed to the ongoing R&D work and development of computer software for design of NDCTs.

### 2. Course on Design of Wind Sensitive Structures (20-24 January 1992)

The main objective of the course is

to highlight the various recommendations of the current wind load code IS:875 (Part 3)- 1987 and to familiarise the designers, researchers and field engineers with the latest developments in the area of wind engineering.

For further details write to : Dr T.V.S.R. Appa Rao/Shri S. Gopalakrishnan, Course Coordinators, SERC, CSIR Campus, Taramani, Madras 600113. □

### National Symposium on Substitute for Wood in Buildings

As a part of Golden Jubilee Celebrations of CSIR, the Central Building Research Institute (CBRI), Roorkee, will be organizing a National Symposium on substitute for wood in buildings in Roorkee during 12-13 December 1991. The aim of the symposium is to stimulate basic and applied research intended to increase knowledge in the field of development of material and technology as alternative to timber.

The symposium will cover scientific and technical papers on subjects, such as polymeric building materials as wood substitute, fibre reinforced composites, ferrocement and other inorganic products, material properties, standardization and durability aspects, energy conservation and pollution control through use of alternative building materials, etc. The symposium will also include other aspects such as financing, production, marketing, onsite fabrication, cottage industry production, artisan training, architectural appropriateness, taxation, pricing and user's response, etc.

For registration and other enquiries, please contact: Dr R.K. Jain, Convener, and Head, Organic Building Material Division, CBRI, Roorkee-247667. □

## COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH

The Council of Scientific & Industrial Research completes 50 years of its service to the country on 26 September 1992. The period between 26 September 1991 and 26 September 1992 is being celebrated as CSIR's Golden Jubilee Year.

The Council and the national laboratories under its auspices are organizing 8 symposia including the one on Metallic Corrosion in Hindi as part of its Golden Jubilee Year celebrations. Schedule for the same is indicated below:

Sr. No.	Title	Dates	Place	Principal Organizer
1.	Substitute for Wood in Buildings	December 12 - 13, 91	CBRI, Roorkee	Director, CBRI
2.	Current Trends in Leishmania Research	February 12-14, 92	IICB, Calcutta	Director IICB
3	Biology and Medicine of Tropical Diseases	February 17-20, 92	CDRI, Lucknow	Director, CDRI
4	Organic Chemistry Focus on Emerging Interface	March 2-3, 92	NCL, Pune	Director, NCL
5	Recent Advances in Chiral Syntheses	April 2-3, 92	IICT, Hyderabad	Director, IICT
6	Earthquakes and Mitigation of Related Catastrophies	May 27-28, 92	RRL, Jorhat	Director, RRL
7	Ocean Technology	August 27-29, 92	NIO, Goa	Director, NIO
8	धातु संहारण से सचर्चा कल, बाज और कल	September 9-11, 92	NML, Jamshedpur	Director NML

Interested scientists are requested to contact Principal Organizers of the respective Symposium or to write to Head, Human Resource Development, CSIR, Rafi Marg, New Delhi-110001. □

### New Subscription Rates for PID Popular Science Journals

The subscription rates of the popular science journals *Science Reporter*, *Vigyan Pragati* and *Science ki Duniya*, published by the Publications & Information Directorate (PID), New Delhi, are being revised with effect from January 1992. The revised rates will be as follows.

	Single	Annual	2 Years	3 Years
1. Science Reporter (English) Monthly	5.00	50.00	90.00	125.00
2. Vigyan Pragati (Hindi) Monthly	4.00	40.00	75.00	100.00
3. Science-ki-Duniya (Urdu) Quarterly	3.00	10.00	—	—

The supply to the current subscribers will continue at the existing rates. Those enrolling themselves as annual subscribers before 1 Jan. 1992 will be entitled to pre-revised rates.

Subscriptions by M.O./cheque/DD, payable to Publications & Information Directorate, New Delhi, may be sent to: The Sales & Distribution Officer, PID, Dr K.S.Krishnan Marg, New Delhi 110012. □

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# CSIR NEWS



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Covered in this issue are two Indo-US workshops : (1) Current Approaches for Receptor Studies in Neurobiology (p 274) and (2) Underground Space Technology (p 275). The photograph shows Shri P.A. Sangam, Minister of State for Coal, inaugurating the workshop on Underground Space Technology. Others seen on the dais (from left) are : Dr Raymond L. Sterling, International Tunnelling Association, USA; Prof. B.B. Dhar, Director, CMRS; Dr S.K. Joshi, Director General, CSIR, and Dr A.K. Dube, Scientist-in-charge, CMRS Extension Centre, Roorkee

## IN THIS ISSUE

Library Life Cycle Tester	276	Employment Generation	278	CSMCRI Annual Report 1988-89	281
Brainstorming Session on National Hazardous Waste Management Programme	277	Workshop on Quick Access Information System of CSIR	280	Special Issue of JSIR on 'Technology Management'	283
Seminar on Impact of Science and Technology on Science and		PROGRESS REPORTS		Bhatnagar Prize-winning Work of Dr J.S. Yadav	284
		RRL-Jammu Annual Report 1989-90	280		

## Indo-US Workshop on Receptor Studies in Neurobiology

The Indo-US Workshop on 'Current Approaches for Receptor Studies in Neurobiology' was held at the Central Drug Research Institute (CDRI), Lucknow, from 23 to 25 September 1991. The workshop was sponsored by CDRI, Department of Science and Technology, U.P. Council of Science and Technology and the National Institute of Drug Abuse, Rockville, USA. The workshop was inaugurated by Prof. P.N. Tandon, CSIR Bhatnagar Fellow and President of the Indian National Science Academy, and presided over by Prof. K.N. Agrawal, Director of the Sanjay Gandhi Post-Graduate Institute of Medical Sciences, Lucknow. Dr Rao S. Rapaka was the leader of the US delegation.

Inaugurating the workshop, Prof. Tandon traced the important role of brain recognized by medical scientists from the time of Hippocrates, down to the recent advances in brain research, which enable study of biochemical changes at the molecular level in a person engaged in normal activity. Prof. Tandon explained how the studies on macromolecular receptors have revolutionized our understanding of brain function. He highlighted the importance of the workshop for the researchers in updating their knowledge on developments in the rapidly growing field of neurobiology and hoped that the cooperation between scientists of India and USA will be beneficial to both the sides.

Earlier, welcoming the participants, Prof. B.N. Dhawan, Director, CDRI, gave a brief account of researches going on in India in this area and the leading role being played by CDRI in developing drugs for management of diseases of the Central Nervous System (CNS).

Dr Rapaka lauded the work of Indian scientists in the area of receptor studies in neurobiology. As the workshop was being held under the aegis of Indo-US Cooperation in Science and Technology, he hoped that it would pave the way for active cooperation between the scientists from the two countries for specific research projects.

The special attention being paid to the researches in the area under the Indo-US S&T initiative and other bilateral programmes was discussed by Dr R.K. Bhatnagar of DST.

Delivering the presidential address, Prof. Agrawal recounted the progress made in the area. He said that now scientists were in a position to tinker with almost any part of the brain with precision. This, he said, has been made possible because of the latest technological breakthroughs.

Thanking the delegates and visiting scientists, Dr R.C. Srimal, Deputy Director and Head, Pharmacology Division, CDRI, ex-

pressed hope that the proceedings of the conference would be published in the near future for the benefit of all concerned.

The workshop was attended by 14 scientists from USA and about 100 Indian scientists which included about 35 young scientists. The workshop was followed by satellite workshops at Waltair, Delhi and Hyderabad, to enable the US scientists interact with neurobiologists working in those parts of the country.

The discussions and paper presentations in over ten sessions and a poster presentation session covered various aspects of ligand and receptor interaction and recent technological developments used for receptor mapping, localization, isolation and sequencing as well as drug-receptor interaction. The discussions provided new insights into physiological regulation of neural activity with particular reference to neuropeptides and mechanism of action of drugs working on central nervous system, besides understanding the



Seated on the dais during inaugural session of the Workshop on Current Approaches for Receptor Studies in Neurobiology (from left) are: Dr R.C. Srimal, Dr R.K. Bhatnagar, Prof. K.N. Agrawal, Prof. P.N. Tandon and Prof. B.N. Dhawan. Dr Rao S. Rapaka speaking on the rostrum is not covered in the picture



basic causes of neurological diseases and the development of novel lead compounds for their management.

Dr Horace Loh of the University of Minnesota, USA, highlighted the problems in studying membrane receptors in central nervous system and the different approaches currently being followed world over for these studies. Dr J.S. Fowler and her group from New York explained how metabolic and other biochemical changes as well as structural details of various parts of brain could be visualized with the recent techniques of Positron Emission Tomography (PET) and SPECT, using radio tracers. This, she said, could be done even in a normal thinking brain. Reviewing the various pharmacological approaches to the study of receptors, Prof. B.N. Dhawan, highlighted the contribution of these classical techniques and said that they have been now complemented but not replaced by techniques of molecular biology.

Studies on drug addicts carried out by several speakers revealed how brain receptors are modified in the presence of alcohol, narcotics or drugs like amphetamine. Highlighting the effect of these drugs on metabolism in different areas of the brain, they stressed that the mechanisms and site of action of these drugs was today better defined. This helped scientists to not only have a better understanding of brain function but also to answer why only some people get drug addiction. It has also helped in devising better approaches to combat drug abuse. Dr R. Hammer of Hawaii, USA, explained the changes produced in different parts of the brain as a consequence of drug induced psycho-stimulation; these changes, in turn, being responsible for urge to continue their intake.

While most of the US scientists presented their work using latest physical techniques, a large number of Indian scientists focussed on biological research being carried out in this field in India. Dr David Zarling of California, USA, spoke about the applications of the latest confocal laser microscopy in understanding molecular mechanisms in neurobiology. Dr T. Desiraju of National Institute of Mental Health & Neurosciences, Bangalore, explained the role of various receptors as studied through micro-electrical stimulation in certain parts of the brain. Dr Nitya Anand, former Director of CDRI, showed how synthesis and evaluation of structurally rigid molecules

help in deciphering receptor conformation.

Among others who presented their work were Dr Veena Bijlani of the All India Institute of Medical Sciences, New Delhi, who explained how the foetal brain develops and Dr Stephen B. Dunnett from Cambridge, UK, who described the role of receptors in ageing and memory.

Speaking during the valedictory session of the workshop, Dr Nitya Anand and Dr Rapaka expressed the hope that such workshops will be periodically organized in future. Prof. Sadee of the University of California suggested that the next joint Indo-US workshop should be held in USA. □

## **Indo-US Workshop on Underground Space Technology**

A four-day Indo-US Workshop on Underground Space Technology was organized in New Delhi, during 30 October - 2 November 1991, by the Central Mining Research Station (CMRS), Dhanbad. Attended by a large number of experts working in the field, the workshop was inaugurated by Shri P.A. Sangma, Minister of State for Coal. Dr S.K. Joshi, Director General, CSIR, presided over the inaugural session.

Inaugurating the workshop, Shri Sangma called upon the scientists and technologists to help solve the problems pertaining to low productivity in mines, mine fires, development of low-cost stowing techniques and utilization of voids created owing to mining.

Dr S.K. Joshi in his presidential address assured the Minister that CSIR would provide all help in solving the pressing problems of the coal mining industry. Welcoming the growing Indo-US cooperation in the field of underground space technology, he hoped that the interaction would grow further.

Prof. B.B. Dhar, Director, CMRS, delivered the welcome address. In his address he highlighted the importance of the subject in the national context and informed that the underground space technology is an upcoming R&D effort of his laboratory in the form of a thrust area project for the eighth five year plan.

Speaking on the occasion, Dr Raymond L. Sterling, International Tunnelling Association, USA, mentioned about the various areas in which the underground space technology assumes great importance. He also highlighted the R&D efforts of his country in this direction.

The workshop dealt with various themes connected to underground space technology, a subject common to mining and civil engineering. The technology is used for constructing metros, hydro-electric power plants, underground storage for industrial products and food grains, etc.

The first session was on Planning and Design of Underground

Space. The papers presented in this session included those on: Design of Underground Structures in USA by Birger Schmidt, and FEM Applications for Underground Space Technology by Prabhat Kumar and Dr N.S. Bhal.

Covering recent trends in the field, the second session had papers on: Recent Developments in Geotechnical Research in USA by Jaak J.K. Daemen and Some New Concepts for Stresses in the Earth's Crust by Dr P.R. Sheorey.

Reinforced Rock Rib — A New Concept Proposed for Supporting Underground Openings by Prof. B. Singh, and Strategy for Faster Tunneling in India by Dr J.L. Jethwa were the presentations made in the third session devoted to Construction Technology.

The fourth session was on Legal Issues and Construction Management. The opening remarks by Michael Barker were followed by a paper on Underground Works: Some Contractual and Legal Aspects by H.V. Mirchandani.

Monitoring of Underground Structures was the theme of the fifth session. Control of Ground Movements and Support of Tunnels — Research and Practice in India by Prof. D.K. Ghosh and Long-term Performance Observations for Underground Power House Cavity in Complex Geology in Lesser Himalayas were the two papers presented.

The sixth session discussed the Use of Underground Space. The following two papers were presented: Introduction of Underground Space Utilization by R.L. Sterling, and Can Underground Voids in Coal Mines be Used for Storage of or Any Other Purpose? by Dr N.C. Saxena.

Site Investigations for Underground Excavations by Dr V.M. Sharma, and Geotechnical Evalua-

tion for Underground Excavation by Dr T.N. Singh were the two papers included in the session on: Geotechnical Considerations & Site Evaluation.

The workshop concluded on 2 November. Prof. S.K. Khanna, Vice Chairman, University Grants Commission, delivered the valedictory address highlighting the importance of the workshop and its relevance to India.

Dr R.K. Iyengar, Additional Director General, CSIR, in his presidential address stressed the need to develop the user-based technology. Stating that the involvement of the beneficiaries would lead to better utilization of the developed technology, he suggested that the storage of water and food underground will be the areas of importance to the nation. The agencies dealing with energy may be the possible beneficiaries and supporters of the R&D efforts.

Dr Peter Hydemann, Science Counsellor, Embassy of USA, stressed the need to strengthen the Indo-US collaboration in such fields of science which are the necessity of the present.

The following recommendations that emerged from the deliberations of the workshop, were presented by Prof. Dhar.

The use of abandoned mines and the need to modify existing mining methods to make available suitable underground space for use needs serious investigation.

A Centre for Underground Space Technology should be established in India, on the model of Underground Space Centre at Minnesota, USA.

A committee be formed to study the feasibility of some high priority underground uses. The problems of major underground construction be identified and ways and means to redress them be found by

suitable technical and administrative changes.

There was a call to endorse the ITA's (International Tunneling Association) policy statement on subsurface planning adopted by the ITA on 17 April 1991.

The interaction between the Indian and the US experts must grow and as a follow-up, another workshop be held in USA to assess the progress of interaction.

The CMRS and the Underground Space Centre of University of Minnesota would act as nodal agencies in the respective countries to pursue the recommendations further.

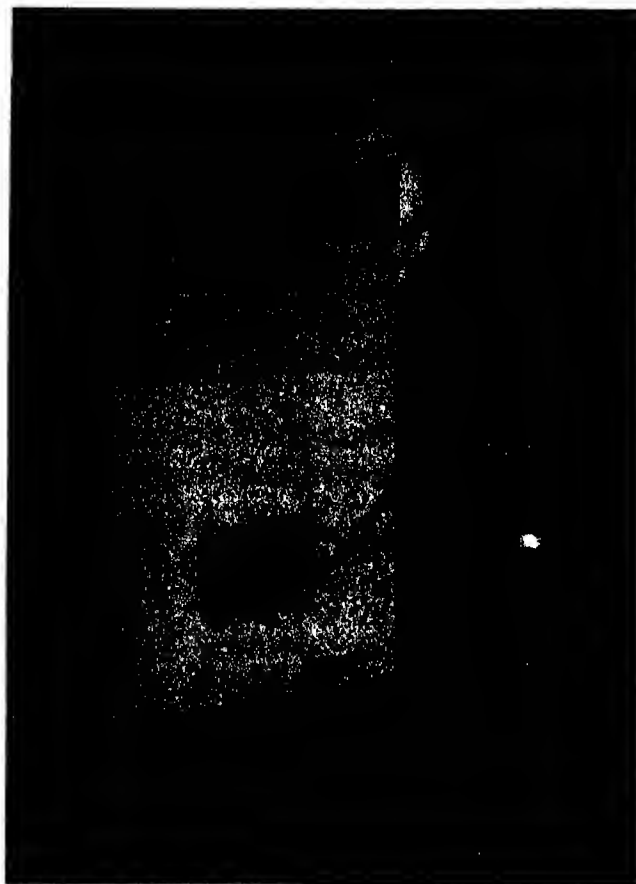
Dr A.K. Dube, Organizer of the workshop, assured that recommendations of the workshop will be followed up and hoped that the Indo-US collaboration in the field will continue to grow. □

## **Battery Life Cycle Tester**

The Central Electrochemical Research Institute (CECRI), Karaikudi, has developed a solid state battery life cycle tester capable of providing standard charge and discharge cycles on a 12 volt secondary battery system. The tester makes use of some VLSI timer chips of great versatility. Charge and discharge times can be set independently from 00 hours 00 minutes to 59 hours 59 minutes. Number of charge/discharge cycles can be set from 0001 to 9999. Lower cut-off voltage can be fixed from 0 to 12 V.

Charging voltage is settable from 0 to 25V. Discharging current can be set from 0 to 20 A. This instrument has been designed for constant voltage charging and constant current discharging. Charge/discharge indicators are

Solid state battery life cycle tester developed by CECRI, Karaikudi



available. Battery back-up is available for the timing/control circuits.

#### TEST SPECIFICATIONS

Test parameters	Value	Resolution
Test battery voltage	12V d.c. —6 cells	-
Current charge/discharge	0-20 A	0.1 A
Voltage, charge	12-25.00V	±0.01 V
Voltage, discharge	8-25.00V	±0.01 V
Cycles	1-9999	-
Charge/discharge time	0-59:59 h or 0-59:59 min.	1 min. 1 s □

### Brainstorming Session on National Hazardous Waste Management Programme

The National Environmental Engineering Research Institute (NEERI), Nagpur, organized an MEF sponsored brainstorming ses-

sion on National Hazardous Waste Management Programme; Environmental Impact and Risk Assessment; and Development and Demonstration of Cleaner Technologies of Industrial Production, during 9-10 August 1991

Following recommendations emerged from the session:

1. Recognizing the risks posed to human health and environmental quality due to inappropriate disposal of hazardous wastes and accidental release of toxic and hazardous substances from industrial activities, hazardous waste management should continue to be closely monitored by the Ministry of Environment & Forests.

2. The indiscriminate disposal of hazardous wastes on land and water bodies has caused major environmental problems leading to extensive damage to the flora and fauna. Such practices also endanger human health. There is a

need to delineate an effective action plan for the prevention of such disposal practices through regulatory framework as also by encouraging voluntary activity.

3. One of the major problems in the management of hazardous wastes is the lack of information flow in regard to the treatment and disposal technologies. Available technologies need to be publicised and others evolved for rendering the wastes innocuous before their disposal.

4. The treatment and disposal methods need to be developed for specific wastes by the generator and reported to the authorities to obtain consent for their adoption.

5. Sporadic R&D in hazardous waste management notwithstanding, there should be a concerted and coordinated endeavour on the part of MEF to encourage and fund R&D activities in the emerging and challenging area of hazardous waste management with emphasis on field application.

6. Recognizing the need for basic research in this emerging area for possible commercial exploitation in the long range, it is necessary for MEF to consider funding of high quality basic research programmes besides short range application oriented projects.

7. There is a felt need for pinpointed and well-defined short, medium and long range R&D programmes in the areas of measurement and monitoring; waste minimization; collection, storage & transportation; treatment & disposal; and restoration of environmental quality through the application of innovative techniques, processes and tools.

8. It is necessary to identify potential locations for siting, treatment and disposal facilities for hazardous waste with recourse to

environmental impact and risk assessment methodologies.

9. The guidelines being issued by MEF provide for the identification of disposal sites as well as the abandoned sites where enormous quantities of hazardous wastes have already been indiscriminately disposed of. There is an urgent need to delineate an action plan for clean-up operations in this context.

10. The hazardous wastes (management and handling) rules provide for control of 18 categories of wastes listed in the schedule. The regulatory quantities for handling hazardous wastes have been stipulated in terms of the hazard content of the waste. However, in view of the difficulties experienced by the agencies in the implementation of the stipulations, this issue requires re-examination.

11. It is necessary to establish criteria for landfilling of hazardous wastes as well as regulatory standards for air emissions from incinerators based on environment and health considerations.

12. The establishment of centralized treatment and disposal facilities to handle multiple hazardous waste generating facilities in a region offers advantages of cost-effectivity and efficient operation. The regulatory agencies need to explore this possibility particularly in cluster of industries under their control.

13. There is a need to evolve a timeframe for the reporting, treatment and disposal of the hazardous wastes by the industry and also a timeframe for the grant of required consent by the regulatory authority.

14. A specialized information base for generation and dissemination of legislative measures as well as data on all aspects of hazardous waste management should be planned on networking mode in

consultation with TIFAC. It is also necessary to devise ways of information sharing with people, especially those likely to be affected by the activity.

15. It is necessary to support specialized institutions for delineation of a framework and its calibration for scientific risk assessment with focus on quantification, and to devise disaster management plan relating to hazardous waste

### **Seminar on Impact of Science and Technology on Science and Employment Generation**

A two-day Seminar on Impact of Science and Technology on Society and Employment Generation was organized at the Central Electrochemical Research Institute (CECRI), Karaikudi, during 15-16 August 1991 under the joint auspices of Science and Technology Entrepreneurship Development Task Force [STED TF] of Pasumpon Thevar Thirumaganar [PTT] District (DST, New Delhi), CECRI, Rural Science Forum of CECRI, Swadeshi Science Movement and Village Planning Forum of Kundrakudi. The seminar was inaugurated by Prof. Hiten Bhaya, Chairman, NSTED Board, DST, New Delhi; Prof. S.K. Rangarajan, Director, CECRI, presided.

Prof. Bhaya in his inaugural address stressed the need for employment generation by concentrating more on entrepreneurial development so that people could be self employed and in the process, create jobs for others in their units. For this purpose Science and Technology Entrepreneurial Parks [STEP] were being set up near educational institutions to provide facilities to students.

Prof. Rangarajan in his presidential address said that Kundrakudi experiment has proved that science and spiritualism could coexist and help in changing the attributes of the

generating as well as treatment and disposal facilities.

16. The standards for operation and control of hazardous waste treatment and disposal facilities need to be developed and widely disseminated. Pollution Control Boards need to be strengthened for monitoring and surveillance of all activities connected with hazardous waste management. □

people. He lauded the efforts of Adigalar in promoting scientific temper in the villages and, thereby, banishing superstition and fear among the people.

Dr R. Thiagarajan, Adviser, DST, said that Science and Technology would be the tools of the future for employment generation.

Thavathiru Kundrakudi Adigalar in his address mooted the idea of establishing People's Bank so that the people of the district become partners and this, he said is imperative for overall development. In this connection he expressed his desire for taking the cue from the self employed women's association of Gujarat under the leadership of Smt Ela Bhatt.

About 200 delegates from all over India participated in the seminar. The deliberations in four technical sessions included special lectures by eminent personalities like Smt. Ela Bhatt, Magsaysay Awardee; Dr S. Muthukumaran, Vice-Chancellor, Bharathidasan University, Trichy; Dr P. Richard Masilamani, Vice-Chancellor, Tamilnadu Veterinary and Animal Sciences University, Madras; Prof. S. Jayaraj, Vice-Chancellor, Tamilnadu; G.D. Naidu, Agricultural University, Coimbatore; Dr T.C. Mohan, Vice-Chancellor, Annamalai University, Annamalai

Nagar; Prof. M. G. Muthukumaraswamy, Dean, Medical College, Annamalai University; Smt Qudsia Gandhi, District Collector, PTT District and Thavathiru Kundrakudi Adigalar. Dr K. Balakrishnan, Deputy Director, CECRI, welcomed the gathering.

Smt Qudsia Gandhi was the Chief Guest for the valedictory function held on 16 August 1991, which was presided over by Prof. S.K. Rangarajan. Following recommendations were made:

#### **Agriculture**

1. In view of the paucity of quality seeds, especially vegetables, it is recommended that each district should have a model and modern seed farm, either under voluntary agency supported by government or under the Department of Agriculture, with technical guidance of Agricultural University;

2. Each panchayat should identify the extent of wasteland and prepare proposals for bringing it under cultivation, either as forest land or agricultural land over a maximum period of five years.

This scheme should involve the people's movements and government agencies, both Central and State;

3. Each panchayat should also take effective steps to avoid soil erosion and bring about soil conservation till the above programme is implemented;

4. Each district should have a horticulture farm producing plants for use in the district and for effective popularization of horticulture. The resources of unemployed should be utilized for this purpose under a suitable voluntary organization with partial government support;

5. A model integrated farm should be set up in each district, to start with, for training the rural

youths in modern agriculture and animal husbandry methods;

6. Facilities for effective and speedy analysis of soils including micronutrients should be made available in each district; mobile units should be modernized;

7. Periodic report on water resources should be made available to the villages and effective water management methods be taught;

8. Popularization of biofertilizers, setting up of production units and popularization of biocontrol of pests;

9. Practical training for rural youth, on agriculture including post-harvest technologies and health care should be organized.

#### **Animal Husbandry**

1. In spite of the great boost to the dairy, it is seen that quality calves are not available for purchase by the farmers. The requirements of the districts should be identified and calf-rearing centres should be established, one in each district;

2. More centres should be opened for the production of

poultry chicken for supply to poultry farms in the district.

#### **Fisheries**

In view of non-availability of fingerlings in villages, it is recommended that each district should have a farm for the production of fingerlings to be made available to the panchayats during monsoon for cultivation in the local tanks, for augmenting the income of panchayat.

#### **Mushroom Spawns**

Each district should also have farms for production of mushroom spawns.

#### **Industrial Training**

Each district should have a well-equipped multipurpose workshop which should be open to the rural youth for training and production of multipurpose goods on rental basis by making use of goods. Similar workshops should also be set up in electronics.

#### **Cooperative Movements**

Substantial and effective help should be given for organizing industrial cooperatives in rural areas. It should include training of



Prof. S.K. Rangarajan, Director, CECRI, delivering the presidential address at the Seminar on Impact of Science and Technology on Society and Employment Generation

the rural youth in managing cooperative societies and other industries. □

### Workshop on Quick Access Information System of CSIR

To provide easy and timely access to information on research activities of its institutes to the mass media, CSIR has formulated a Quick Access Information System (QAIS) [CSIR News, 41(1991), 138]. CSIR will be holding workshops in different regions of the country to make the media persons and science writers aware of QAIS.

One such workshop was organized by the Central Glass & Ceramic Research Institute, Calcutta, on 20 September 1991, at the instance of CSIR. Mass media personnel from Doordarshan, All India Radio and science correspondants/writers from different newspapers and news agencies participated in the workshop. Scientists from CGCRI, IICB-Calcutta, NML-Jamshedpur, CMERI-Durgapur, CFRI-Dhanbad and RRL-Bhubaneswar also attended. The main aim of the workshop was to

interact with the mass media people concerning the utility of QAIS and to assess their precise requirements so that the system could be further improved upon.

Dr B.B. Nag Chaudhury, former member of the Planning Commission, Government of India, inaugurated the workshop. Renowned science writers like Shri Samarjit Kar, Dr Alok Sen and others addressed the participants. A detailed report on QAIS was presented and it was followed by practical demonstration. Prof. Sushil Mukherjee, former Vice-Chancellor, Calcutta University, chaired the panel discussion which included floor participation. □

### PROGRESS REPORTS

#### RRL-Jammu Annual Report: 1989-90

The Regional Research Laboratory (RRL), Jammu, carries out its R&D activities in the following areas: Drugs and Pharmaceuticals, Natural Products (cultivation, processing and chemistry), Biotechnology, Post-harvest Technology of Regional Agro-horticultural Produce, Mushrooms,

Utilization of Mineral Resources, Sericulture, Insect Physiology, Utilization of Cellulosics and Processing of Sheep, Goat and Fur Skins. The laboratory is also contributing to the Oilseeds and Literacy Missions. A brief account of the R&D activities/achievements of the laboratory during the period 1989-90 is presented here:

Kutkin (a mixture of iridoid glycosides, picroside I and kutkoside, isolated from *Picrorhiza kurroa*) was found to enhance the humoral antibody response to SRBC in rats. The effect was comparable to muramyl dipeptide (MDP) and levamisole. In partially immune suppressed rats, concomitant administration of kutkin with azathioprine for 5 days or betamethasone for 3 days following immunization produced a dose related increase in antibody titre. In acute toxicity studies conducted, kutkin was found to be virtually non-toxic.

Labomin (a water soluble formulation of methaprene) and EBP-E (soluble in alcohol) were tried in silkworm (*Bombyx mori*). It was found that maximum efficiency of the compounds could be obtained by spraying both on mulberry leaves and worms. The optimum doses worked out for getting maximum productivity of silk are: labomin 0.25 µl/larva and EBP-E 0.15 µl/larva in 5 µl solution.

An earlier observation of induction of sterility in *Dysdercus koenigi* with the rise of temperature by a few degrees above the ambient gave a clue for the application of this finding on stored grain pests. Studies made during the year showed that the emergence of adults in case of pupae of three stored grain pests, i.e., *Trogoderma granarium*, *Callosobruchus chinensis* and *Tribolium castaneum* is inhibited at 45°C.

Simplified units for the mechanical harvesting of flowers of



Dr B.D. Nagchaudhury, former member of the Planning Commission, inaugurating the Workshop on Quick Access Information System for Mass Media at CGCRI, Calcutta



saffron (*Crocus sativus*), separation of stigma, stamens and petals, and separation of stigma and style or Laccha Separator were developed and tested under field conditions. Studies on dehydration and storage of saffron were also conducted and various parameters standardized. Polyethylene bags of 100 gauge were found suitable for storing saffron.

Design of a commercial plant for the production of rutin was given to M/s R.B. Jodha Mal & Co., Jammu. The process was demonstrated on pilot plant scale to the party by processing 4 tonnes of eucalyptus leaves.

The plant for the manufacture of 16-DPA from diosgenin for Directorate of Cinchona and Other Medicinal Plants, Government of West Bengal, was installed and commissioned after giving a few successful demonstration runs.

A portable steel kiln for making charcoal from *Lantana camara* weed was designed and fabricated for Soil Conservation Department of J&K Government and the trial runs were conducted successfully.

The studies conducted regarding the correlation of the oil content and its constituents with the maturity of the tree in *Juniperus excelsa* revealed that young trees (age 31-70 years) contain high oil content (5.2-5.6%) after which oil content decreases (3.1-4.0%). There was no significant difference in the cedrol content in oil.

From the segregating population M<sub>2</sub> of the γ-rays treated plants of *Vernonia anthelmintica*, nine desirable plants type were identified with higher seed yield (18.4-23.69 g/plant), oil content (16.2-32.4%) and vernolic acid content (64.5-77.6%) compared to 13.5 g, 14.3% and 53.2% respectively in parent plant.

More than 0.3 million mulberry cuttings of improved varieties were

supplied to various departments of J&K and H.P. Fifty thousand plants of recently introduced *Salix* species were supplied to J&K Forest Department for afforestation work.

Under the section on large scale processing of lignocellulose for composite boards/fibre boards were prepared from green stems of *Leucaena*. About 100 fibreboard sheets of the size 75 x 60 cm were made. Medium density fibreboards were also made. Fibreboards were also made using rice straw and sarkanda (*Saccharum munja*). More than 70 fibreboard sheets were made. Also phenolic resin treated jute fibre sheets were laminated with *Leucaena* particle boards and medium density fibreboards. Test results of laminated composite boards indicated that lamination improved the modulus of rupture, dimensional stability and surface properties.

Large number of composite sheets were made both on laboratory and pilot scale. Laminates based on material such as jute fibre, glass tissue sheets, paper board and cotton cloth were made under varying conditions and combinations. The hybrid composites made by the laboratory were found to be much superior in strength and water resistance properties compared to ordinary lignocellulosic boards.

Patents were filed for the three processes developed by the laboratory for the manufacture of nifedipine and preparation of two pharmaceutical compositions. Processes were also developed for some food products suitable for diabetic people, important ones being RTS beverage and amla preserve.

Training was imparted to 25 women in silkworm rearing, reeling and weaving of silk at Ritti (Jammu Division). Two weeks special training in preparation of mushroom

spawn was imparted to two officers of Agriculture Department (Government of Sikkim) by the laboratory.

Fur products developed by the RRL, Jammu's Branch Laboratory were demonstrated to rural people of Madhya Pradesh. A workshop was organized on 'Perspectives in the Development of Apricot Processing Industry in Kargil Ladakh' at the Srinagar Branch Laboratory. □

### CSMCRI Annual Report: 1988-89

The major R&D activities of the Central Salt & Marine Chemicals Research Institute (CSMCRI), Bhavnagar, during 1988-89, continued to be devoted to the development of technologies for edible and industrial grade salt and marine chemicals, conversion of saline water to potable water, economic utilization of sea-weeds, wasteland development, and to the studies related to homogeneous catalysts. CSMCRI contributed to the Technology Mission on Drinking Water as the lead laboratory and also played an important role in the Wasteland Development Mission. The institute's reverse osmosis technology package proved to be most competitive among the global offers invited by the Government of Thailand. The electrolysis process for sea water conversion to potable water was nearing completion.

During 1988-89, CSMCRI process on reverse osmosis was licensed to M/s Arro Technologies Pvt. Ltd (Ahmedabad); solar stills to the National Institute for Training in Industrial Engineering (Bombay), Shri Shaikh Usman (Gogha) and Shri J.P. Patel, BPTI (Bhavnagar); table salt/dairy salt to M/s Sumit Salt & Marine Chemicals Ltd (Tuticorin); and table salt to M/s Shri Farm Salt & Marine Chemicals Works (Bombay). The institute completed two consultancy assignments: (i) Study on solar evapora-

tion soak liquor for Tamilnadu Leather Development Corporation Ltd (Madras) and (ii) Preparation of a preliminary technical feasibility report on upgrading of salt by washing in screw conveyor for Shri V. Venkateswarlu (Hyderabad).

For purification of salt, field experiments were carried out on calcium reduction by sodium hexametaphosphate and starch as additives. Sodium hexametaphosphate-treated brine yielded salt having 0.06 - 0.8% calcium content whereas starch-treated brine yielded salt with 0.04-0.07% calcium content.

Experiments were carried out to upgrade phosphogypsum obtained from GSFC, Vadodara. The upgraded phosphogypsum was used for preparing alpha plaster of Paris; compressive strength of up to 195 kg/cm<sup>2</sup> could be obtained.

Calcium gluconate + zinc acetate at 300 ppm concentration was tried as corrosion inhibitor of mild steel coupons fixed in a cooling loop, fabricated as per ASTM standard. Corrosion inhibition of up to 85% could be achieved. The protective potential observed after 6 h running of sea water was 0.60 V against 0.700 V in blank.

Two mobile reverse osmosis plants, each of 15,000 litres/day capacity, were fabricated, erected and commissioned. These plants consist of sand filter, chemical dosing system, high pressure pump, RO spiral module unit, control panel, decarbonator and monitoring equipment, fixed on Swaraj Mazda LCV chasis. The plants were handed over to Gujarat and Tamilnadu governments.

Casting compositions and conditions for CA-CTA blend membrane were optimized on a laboratory scale for the desalination of 35,000 ppm NaCl solution at 800 psi operating pressure. The casting solution compositions were

studied using Eastman and Mysore CA and CTA. The best performance with optimized conditions was: 3.5-4.0 gfd product water and 98.0- 98.5% salt rejection. The results are reproducible on a laboratory scale.

For the treatment of Municipal wastewater of Jetpur township, water samples were collected and analyzed. The colour, COD and BOD were removed by treatment with coagulants followed by polymeric adsorbents/chlorination. A grant-in-aid proposal was submitted to the Ministry of Urban Development for carrying out the field trials. Work on the recovery of potassium and reduction in COD and BOD of the spent wash was continued through various approaches. In one approach, most of the potassium from the spent wash could be recovered as a complex salt, with substantial reduction in colour and COD of the spent wash.

Studies were made on the preparation of interpolymer and base film and the chemical processing for cation and anion exchange membranes for the electrodialysis seawater desalination plant. Based on the laboratory studies, components of a two-stage plant of 5 m<sup>3</sup>/day capacity were fabricated and assembled at the premises of M/s Alcock Ashdown and necessary facilities were set up for drawal of seawater from the creek and settling the same for removal of silt. Some trial runs were also made. The fabrication of another plant of the same capacity was taken up for Lakshadweep Islands.

Bench scale optimization studies on Ru-EDTA-CO complex catalyzed gas shift reaction were completed; 40- 50°C reaction temperature and 15 atm of CO were found to be ideal conditions giving a turnover rate of 350 moles CO<sub>2</sub>/H<sub>2</sub> per mole of catalyst per hour. The process was taken up for

upscaling in a semi-pilot plant with Projects Development India Ltd, Sindri, as collaborator. CO<sub>2</sub> reduction experiments were also performed with soluble Ru-EDTA-CL complex in aqueous medium in the absence and presence of H<sub>2</sub>, which gave improved yields of liquid phase products, formic acid and formaldehyde.

Under the work on reductive catalytic carbonylation of nitrobenzene in ethanol, Ru-Saloph-Cl<sub>2</sub> complex was found to be a promising catalyst system to get phenylurethane which later decomposed to give isocyanate. Optimized reaction conditions for reductive carbonylation of nitrobenzene were found to be 160°C and 20 atm of CO, giving a turnover rate of 6 moles of product per mole of catalyst per hour.

The laboratory was chosen as one of the group members of Indo-USSR Science & Technology Cooperation on Catalysis. The group at CSMCRI is concentrating its efforts on Fischer-Tropsch synthesis, one of the listed items of the collaborative project.

Utilization of plants of marine origin and exotic plants has been receiving the attention of CSMCRI for quite sometime. The institute's studies cover survey of marine algae, its cultivation and utilization. The institute has also been making efforts for cultivation and utilization of jojoba, salvadora, salicornia, as a part of wasteland utilization studies.

The survey of marine algae resources was completed in the Tiruchendur sector; the data were analyzed and a report was being prepared. A total standing crop of 20,000 tonnes was estimated in 442 m<sup>2</sup> area. Some of the more abundant economic seaweeds in this sector include: *Spatoglossum asperum*, *Halymenia* sp. *Hypnea* sp. and *Gracilaria* sp.

Culture of fragments of *Gracilaria edulis* and *Gelidiella acerosa* by SRFT method was tried at Krusadal Island and of *Gelidiella acerosa* at Eravadi. *Gracilaria edulis* plants grew to a length of 12.5 cm with an yield of 1.5 kg/m<sup>2</sup> (wet). *Gelidiella acerosa* was found to grow better at Eravadi; 145 kg (dry) of *G. acerosa* was harvested in the experimental farm at Eravadi.

Growth and phenology of *Gracilaria verrucosa* from natural populations were studied in Bet islands. *G. eucheumoides* was reported for the first time from the Indian coast (Car Nicobar Is). The details of some of its post fertilization stages were worked out.

Seawater and sea bitters were analyzed with a view to studying their effect on the growth and biomass production of seaweeds.

In a bench scale experiment (100g product) on extraction of lambda carrageenan from *Sebdenia* and *Halymenia* spp., 25-30% yield of the carrageenan (dry weight basis) was obtained.

Alginate waste procured from M/s Snap Alginate Ltd was experimented for production of biogas. The waste tried with different percentage of fresh cowdung showed that 20% of fresh cowdung is sufficient to provide methanogens for the production of biogas. The production of gas started after 18-20 days and continued for 33 days at the rate of 1.6 litres gas/kg of waste/day.

Seventy-one research papers were published during the year. □

### **Special Issue of JSIR on 'Technology Management'**

Technology is the principal engine of economic growth in a industrialized or industrializing society and a major determinant of the international status of a country. Technology Management (TM) therefore is

the key to progress and prestige in the modern world. However, the realization that TM ought to be an independent and crossdisciplinary area of study and enquiry is fairly recent. CSIR has taken the initiative to bring the urgency of proper Technology Management to the surface of the consciousness of the planners, administrators, industrialists and research managers through a special issue of the *Journal of Scientific & Industrial Research* (JSIR) on Technology Management (Vol.50, No.10, October 1991; Price Rs 40.00, \$15, £10). This should be among the first initiatives in India on the subject.

Guest-edited by H.R. Bhojwani and V.B. Lal of the CSIR Technology Utilization Division, the special issue has attracted eminent contributors from several countries. Two aspects that receive special attention are: technology transfer from research laboratories, mainly publicly funded, to industry for commercial exploitation, and the coordination between R&D and marketing functions of a company. In all, the issue contains 12 articles. There are two contributions dealing with profound philosophic and epistemological issues, and country reports from the US, Japan, South Korea, New Zealand and India.

Metcalf and Boden suggest that theories of evolutionary change in epistemology, economics and business can contribute significantly to the understanding of technology strategy pursued by firms to gain competitive advantage.

DeGregori puts forth a 'defensible' theory of technology, contending that the theories of technology advanced by the proponents of appropriate technol-

ogy and environmental movements are inherently unsustainable. Moenaert *et al.* present an empirical research study of 40 Belgium companies covering 80 product innovation projects focussing on crossfunctional interpersonal communication behaviour. R. Szakonyi pinpoints absence of guidance concerning market needs as the main reason for failure of technological innovations and suggests way to ensure closer coordination between R&D and marketing functions. BRT Frost discusses commercialization of nationally funded R&D in the US with special reference to Argonne National Laboratory. Mary Spann, Mel Adams and W.E. Souder present a theory and model of technology transfer in entrepreneurship. C. Watanabe and Tanya Clark examine the government industry relationship in Japan and the mechanisms for promoting industrial vitality. Hyung Sup Chov discusses guidelines for commercialization of R&D results in South Korea and the institutional mechanism evolved for the purpose. Peter Winsley discusses the Technology Business Growth initiative in New Zealand. S.K. Subramanian and Y. Subramanian argue that Technology Management in the future will not be a extrapolation of the past but will be a combination of synthesis, symbiosis and synergy. They review the Japanese scene for managing technology and have a few suggestions for Technology Management in India. Graham Vickery focusses on advanced manufacturing technologies. H.R. Bhojwani and V.B. Lal highlight the crucial importance of the way the Government policies are implemented in nurturing indigenous technology through the case study of methyl chlorosilanes technology. □

## Bhatnagar Prize-winning Work of Dr J.S Yadav

Dr J.S. Yadav of the Organic Chemistry Division, Indian Institute of Chemical Technology (IICT), Hyderabad, has been selected (along with Dr Biman Bagchi of the Solid State and Structural Chemistry Unit, Indian Institute of Science, Bangalore) for the Shanti Swarup Bhatnagar Prize in Chemical Sciences for the year 1991.



Working in the field of agrochemicals, Dr Yadav has developed a range of pheromones against various pests of cotton, which are being employed in the fields successfully. Another important area where Dr Yadav has made significant contributions relates to hydroxyfatty acid compounds produced by rice plants to gain self-immunity against rice blast disease.

He has developed commercial processes for various anti-cancer agents such as mitoxantrone and carboplatin, anti-TB drugs like pyrazinamide and vitamins. Synthesis of antibiotics like sesbanimide, cervinomycin, anthracyclines, rifamycin, calcimycin and immunosuppressive agents, etc. are his other important achievements.

He is currently working on Taxol, the much sought after anticancer drug which can be used

when other drugs fail as resistance develops and it is the only one effective against ovarian cancer. He is also involved in research project in collaboration with TNO of The Netherlands, to isolate, identify, synthesize and implement pheromones against pests of other important cash crops like groundnut. New processes for such compounds are being developed under sponsored projects funded by pharmaceutical and agrochemical industries, and in basic sciences, various international collaborative projects with US, France and USSR are ongoing.

Dr Yadav (born August 1950) after obtaining his M.Sc. degree in Chemistry from the Banaras Hindu University joined the National Chemical Laboratory (NCL) Pune, as a CSIR research fellow. He accompanied Dr Sukhdev to Maltichem Research Centre, Baroda, and finished his Ph.D. work in 1976. Later he went to USA and worked for three and a half years with Prof. Wenkert at the Rice University, Houston and Prof. C.J. Sih at the University of Wisconsin at Madison, on the synthetic chemistry of alkaloids and anthracyclines.

He returned to NCL in 1981, and developed several methodologies for pheromones and other biologically active compounds. Development of antitumor and anti-TB antibiotics was another area of his interest during his tenure at NCL. He moved to IICT in 1986.

He was elected 'Young Associate Fellow' by the Indian Academy of Science in 1984. He won the FAPCCI award in 1987 and the Dr S. Hussain Zaheer Young Scientist Award in 1990. He has delivered lectures in several national and international symposia.

## PATENTS FILED

189/DEL/91: A process for preparation of stabilized zirconia by plasma, S. Bhattacharjee, U. Syamaprasad, R.K. Galgali and B.C. Mohanty—Regional Research Laboratory, Bhubaneswar.

243/DEL/91: A process for the extraction of potassium from glauconitic sandstone useful for fertilizer application, R.K. Rawlley—Regional Research Laboratory, Bhopal.

244/DEL/91: A process for the preparation of a P K composition from glauconitic sandstone useful for fertilizer application, R.K. Rawlley and S.S. Amritphale—Regional Research Laboratory, Bhopal.

245/DEL/91: A process for the preparation of a PK composition from glauconitic sandstone using lowgrade rock phosphate, R.K. Rawlley and S.S. Amritphale—Regional Research Laboratory, Bhopal.

246/DEL/91: A process for producing a PK composition useful for fertilizer application from glauconitic sandstone, R.K. Rawlley and S.S. Amritphale—Regional Research Laboratory, Bhopal.

247/DEL/91: A process for the extraction of potash from glauconitic sandstone by using common salt, S.S. Amritphale, R.K. Rawlley and B. Kujur—Regional Research Laboratory, Bhopal.

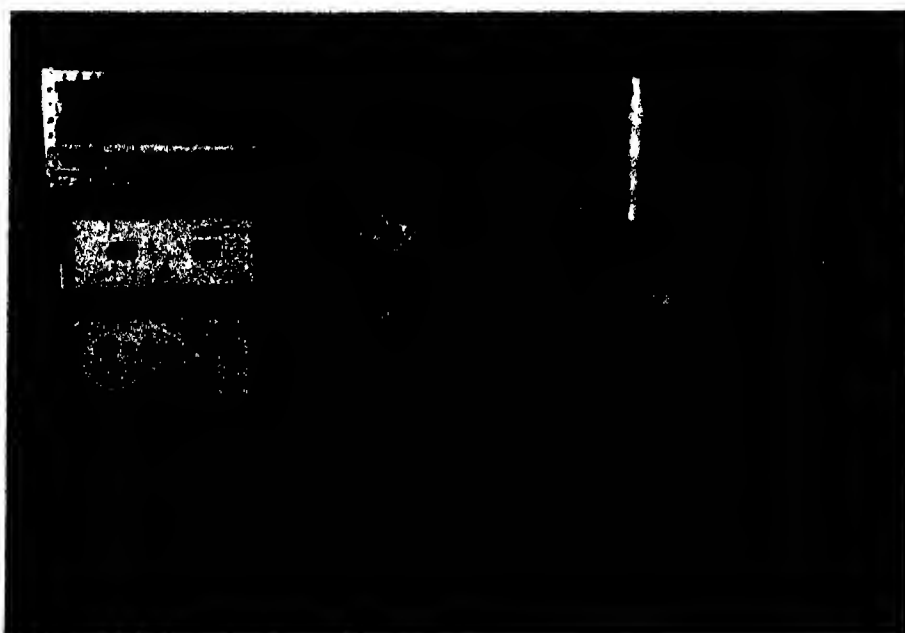
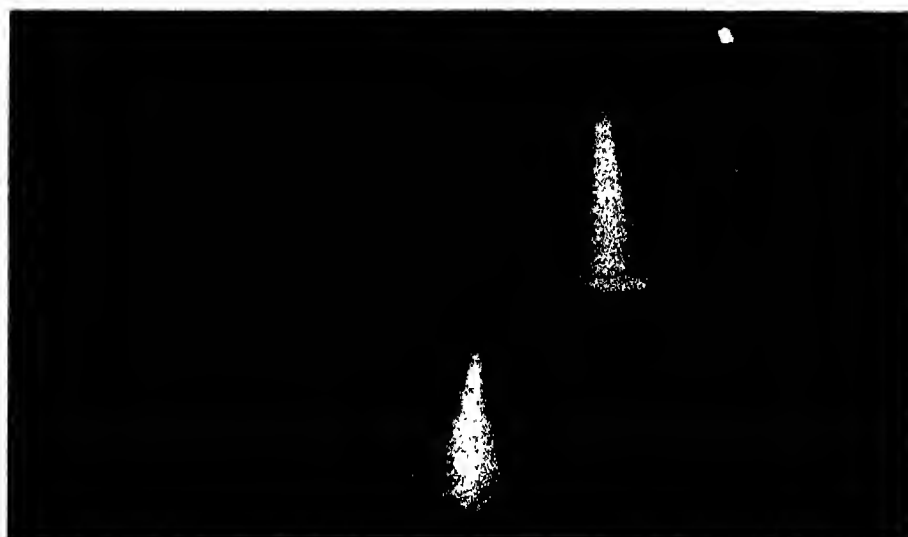
368/DEL/91: A process for the preparation of a pharmaceutical composition with enhanced activity for the treatment of vitiligo, psoriasis, mycosis and fungoides, K.L. Bedi, U. Zutshi, N. Kapoor and J.L. Kaul—Regional Research Laboratory, Jammu and G. Bano—Govt. Medical College, Jammu.

# CSIR NEWS



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A report on the R&D Programme on Plasma being pursued at RRL - Bhubaneswar appears on page 291. Shown here are (clockwise from top left): Multiple plasma torches, Extended arc plasma reactor and Capacitively coupled R F plasma reactor

## Power Generation from Fossil Fuels — Problems & Prospects

A two-day workshop on 'Power Generation from Fossil Fuels — Problems and Prospects' was held at the Indian Institute of Chemical Technology (IICT), Hyderabad, during 20-21 September 1991, under the co-sponsorship of IICT, Max Mueller Bhavan (Hyderabad) and IGNA-Hyderabad.

Shri S. Rajagopal, IAS, Secretary (Power), Department of Energy, who inaugurated the workshop, remarked that coal will be the major fossil fuel for thermal power generation as India has vast resources of coal. Electrical energy is the key requirement for the economic progress of any country, particularly for a developing one like ours, which is at a take off stage. Substantial investment will therefore have to be made in the power sector if the growth rate for GDP is to be maintained.

He informed that the installed capacity for power generation has risen to 66,000 MW in 1991 from about 1700 MW in 1950. The thermal power contributes about 71% to the total power generated. The plant load factor has been rather low and the transmission losses rather high, of the order of 21-23%. Technically this cannot be considered as transmission loss as it includes pilferage also. Actual loss in transmission alone may be 9-10%. This transmission loss varies from State to State and is low in other countries. For example, in FRG it is 7%.

Shri Rajagopal further said that an additional capacity of 38,000 MW was earlier proposed in the Eighth Five Year Plan to sustain the economic growth but this target had to be brought down to 28,000 MW owing to lack of resources and management problems. Perhaps this target may go up to 34,000 MW. He referred to the lack of integrated progress of all sectors

connected with power generation. Initially, pit head plants were set up, as transport of high ash coal was not considered economic. But as the load centres were away from such power plants and as the power transmission facilities were inadequate, power plants along the coast were proposed later. However, a balance has to be made between power plants at pit head and at load centres.



Shri S. Rajagopal inaugurating the Workshop on Power Generation from Fossil Fuels — Problems and Prospects

Referring to the various problems faced by the power sector, Shri Rajagopal said that the quality of coal is deteriorating and adequate supply of good quality coal is not being made to power plants. Fly ash is presenting a serious disposal problem. Instructions are being issued that for all future power plants it will be mandatory to find a use for fly ash, and power plants will have to create facilities for supply of dry fly ash to interested entrepreneurs free of cost for 10 years. Other concessional facilities should also be given to such industries. In order to meet the cost for such a fly ash

plant, it may be necessary in future to levy a cess on power generated.

Regarding pollution from SO<sub>2</sub>, he said that it is not a serious problem as far as India is concerned as the coals available here have a low sulphur content. Hence flue gas desulphurization (FGD) plants are not required at present. The large investment required for such FGD plants (Rs 3500 million for a 1000 MW plant) may be utilized for setting up washeries. Electrostatic precipitators will be provided in all power plants with an investment of Rs 15000 million. India is not responsible for the climatic change and the standards for SO<sub>2</sub>, NO<sub>x</sub> are also not specific. As standards for pollutants like NO<sub>x</sub> are not site specific they should not be imported.

Shri Rajagopal indicated that coal gasification will be given adequate support, and referred to the efforts made by Dr Ram K. Iyengar of CSIR to put up a demonstration plant. His Ministry, he said, has provided about Rs 1000 million for setting up an Integrated Gasification Combined Cycle (IGCC) demonstration plant which will form the forerunner for future commercial plants. Fluidized Bed Combustion is also appropriate for intermediate scale power plants. Use of coal gas in boilers may also have to be examined. He was glad to note that R & D institutes are showing interest in power generation technology and overall economic development. He wanted the environmentalists to keep the need for country's economic development in mind and suggest measures for minimizing pollution.

Shri D. Aurora, IAS, Additional Chief Secretary, Government of Andhra Pradesh, in his remarks as Chairman of the inaugural session referred to the loss in use of power besides the transmission loss. In



A.P. Agricultural sector which consumes about 50% of power, the wastage because of inefficient use is as high as 25-30%. In order to make the agricultural sector conscious of this wasteful use of power and to promote efficiency, taxation may have to be resorted to. For combating pollution, technologies with minimum expenditure will have to be developed.

Referring to the massive threat to the environment by the various pollutants, Dr P.J. Bumke, Director, Max Mueller Bhavan, Hyderabad, emphasized the need to deal adequately with the release of CO<sub>2</sub> into the atmosphere. Dr S.K. Rao of IICT highlighted the activities of his institute in the area of coal. Dr Y.S. Sadanandam, Vice-President, Indo-German NACKONTAKT Association, gave a brief account of IGNA.

Dr Ram K. Iyengar, Additional Director General, CSIR, in his address spoke about the possibility of flotation technique for cleaning finely ground coal. He said that the coal-water mixture is good for easy transport and can be used in place of liquid fuels. To solve the fly ash problem, IGCC may be attractive as ash is transformed into an aggregate in the gasifier stage itself and is not carried to the power plant. He cited the work of CFRI, CBRI and CGCRI on the utilization of fly ash. According to him, fly ash slurry can be used for back filling of pits dug for laying pipe lines.

Dr E. Richter, DMT Institute for Heat and Power Generation, Essen, FRG, referred to the difference in culture between India and Europe. Though science and technology is same all over the world and is meant for serving society, application of technology has to be different for Europe and India to suit local conditions. The Indian coal is different and therefore, the technology has to be different, said Dr Richter.

Dr R. Vaidyeswaran, Convener of the Workshop, proposed a vote of thanks at the inaugural function.

In all eight papers were presented in the workshop. In the paper on 'Thermal Power — Its Importance and Future for India' by Shri S.K. Das Gupta, Member (Thermal), Central Electricity Authority (presented by Shri M.A. Ramanan), the developments in the field of thermal power generation in the country were analyzed under four categories — growth of installed capacity and



Dr E. Richter addressing the Workshop

share of thermal power, increase in unit size, technological development and cost trends. The paper described that the thermal share has increased to about 69% in 1990-91 as compared to 53% in 1975-76. The unit size has also increased to 500 MW from less than 100 MW in late sixties. The cost has increased to Rs 20000-22000/kW from Rs 4600/kW in 1980. The paper predicted that coal will continue to occupy a major portion of power generation capacity, and as coal quality is deteriorating, technologies to effect fuel saving, reduce specific invest-

ment cost and minimize environmental damage have to be developed. Instead of depending on foreign technology, indigenous R&D efforts should be given fillip. New generation technologies like IGCC and FBC should be given due consideration. Maximizing electricity production by sustained R & M efforts in the short term and adopting new and reliable technologies in the long term, improving efficiency by operating the units near rated capacity and fuel oil conservation are some of the strategies suggested.

The paper on 'Efficient Management of Thermal Power Stations in India' by Shri P. Kamala Kumar, Chief Engineer (Generation), APSEB, Hyderabad, presented an analysis of various factors used to judge the overall performance of a thermal station like PLF, specific coal and oil consumption, auxiliary power, energy generated per kW of installed capacity and number of persons employed per MW of installed capacity. Efficient management should also pay attention to fuel, steam and heat loss. It was pointed out that instead of judging the performance of a plant on PLF alone, maintenance index indicating generation loss due to planned and forced outage and fuel index, i.e., heat rate from coal and specific oil consumption should also be considered. The paper referred to the need to utilize the fly ash for manufacturing building materials. The factors for designing the boiler and fuel handling equipment like 'corrosion of fire side surface, slagging and erosion properties of ash, combustion characteristics of coal and moisture content of fuel were also referred to. Newer methods like FBC were also discussed.

Dr E. Richter of DMT Institute for Heat and Power Generation presented two papers. In his first paper on 'Application of Processes for SO<sub>2</sub> and NO<sub>x</sub> Removal in FRG',

he emphasized the need to reduce emissions from coal and oil-fired power plants. In FRG, the annual SO<sub>2</sub> emissions have been reduced from 1.55 million tonnes in 1982 to 0.53 million tonnes in 1989. They are to be further reduced to 0.34 million tonnes by 1993. Over 135 flue gas desulphurization plants (FGD), corresponding to a thermal capacity of 40,000 MWe, are in operation in FRG. For plants with a capacity of more than 300 MW, SO<sub>2</sub> removal to the extent of 85% subject to a maximum of 400 mg/m<sup>3</sup> (STP) in gas is necessary. For NO<sub>x</sub> removal, the standard is 200 mg NO<sub>2</sub>/m<sup>3</sup>. The total NO<sub>x</sub> emissions have been reduced from 0.75 million tonnes in 1982 to 0.2 million tonnes in 1991, for a total capacity of 32,000 MW. The common FGD system uses lime or calcium carbonate for wet scrubbing, giving calcium sulphate as byproduct. Regenerative scrubbing system uses magnesium hydroxide or sodium sulphite as absorbent. The SO<sub>2</sub> thus recovered can be processed to give liquid SO<sub>2</sub>, sulphuric acid or S. Spray adsorption process uses lime water injection and SO<sub>2</sub> is recovered as CaSO<sub>3</sub>/CaSO<sub>4</sub> as dry powder. Active coke can be used as an adsorbent for SO<sub>2</sub> at temperatures of 90-150°C. Scrubbing with ammonia helps in removal of NO<sub>x</sub> in presence of a catalyst like TiO<sub>2</sub>. The selective catalytic reduction step can be used before the air preheater or after FGD. Active coke along with NH<sub>3</sub> helps in simultaneous removal of SO<sub>2</sub> and NO. The various reactions taking place during FGD and NO<sub>x</sub> removal were discussed.

In his second paper on 'Coal Combustion in Atmospheric and Pressurised Fluid Beds', Dr Richter traced the development of FBC and CFBC, the influence of coal quality and additives for reducing CO, NO and SO<sub>2</sub> emissions. The effect of Ca/S ratio, particle size, average

bed temperature and coal ash content on sulphur capture in the bed was discussed. Atmospheric FBC is in use all over the world for a capacity of 30,000 MWth. TVA's bubbling FBC plant of 160 MW and NSP retrofit plant of 125 MWe are some of the large installations. NO<sub>x</sub> emissions from FBC and CFBC were also discussed. PFBC is being developed for combined cycle operation. Two designs — GT cycle with air cooled PFBC and waste heat steam cycle or integrated combined cycle with water cooled PFBC — are being developed. Such PFBC plants are being set up in Stockholm, US and Spain. PFBC combined with gasification is the system being developed by British Coal.

Dr Ram K. Iyengar, Additional Director General, CSIR, in his paper on 'IGCC: An Environmentally Benign and Efficient Option for India' gave an account of the study made by a committee for the selection of appropriate gasification technology for IGCC. He discussed the parameters used for such evaluation process technology efficiency, plant efficiency, economic factors, environmental factors and commercialization status. Data from the trial runs from 24 t/d gasification pilot plant of IICT, and 150 t/d combined cycle demonstration plant of BHEL in Tiruchirappalli were used to evaluate moving bed gasification technology.

Dr Iyengar pointed out that moving bed gasification technology has flexibility in using high ash coal. For evaluating other gasification technologies, data from process licensors were used and a techno-economic evaluation was made for slurry feed entrained bed, dry feed entrained feed and pressurized fluid bed. Slurry feed system was not found suitable due to high ash content and the necessity to add flux. Oxygen-blown dry feed

entrained bed gasifier gives high efficiency, but this advantage is lost due to the large oxygen plant required. Air-blown fluidized bed technology appears attractive. The specific capital cost and cost of power are comparable to pulverized fuel fired plant with FGD. The technology however has been shown on demonstration scale and high ash coal has not been tried. Hot gas clean up is yet to be proved on large scale. Moving bed gasification technology results in higher efficiency than the PC plant. Capital cost and cost of electricity are marginally higher than PC plant. Among the various advantages of IGCC, the lower specific coal consumption results in lower CO<sub>2</sub> emission than PC plant. Dr Iyengar pointed out that it is necessary to build a demonstration plant based on fluidized bed to fully explore this technology for high ash coal.

In the paper on 'Indian Coals and Their Suitability for IGCC Power Generation', Dr S.K. Rao and others from IICT gave a summary of the test data with different coals and Neyveli lignite in the 1 tonne/h pilot plant at IICT, based on moving bed gasification process, and showed that high ash coals can be successfully processed in this type of gasifier. With increasing pressure of gasification cold gas efficiency, gas composition, HHV of gas carbon conversion and specific throughput improve. Though oxygen-steam gasification is superior to air-steam gasification, as it results in higher CV of gas and requires smaller vessel dimensions, the capital and operating costs and auxiliary power requirements are more for the former. Using the data from the elaborate tests conducted in the pilot plant with North Karanpura coal both in oxygen-steam and air-steam modes of operation, the process was scaled up to an IGCC plant of 600 MW capacity, giving an overall efficiency of 34.2% (2514

kcal/kWh based on HHV of coal). Thirteen gasifiers would be required for processing 449 tonnes/h of coal by air-steam mode. IICT is in a position to provide the process design for large gasifiers of 3.7 m diam.

The paper on 'Status of Fluid Bed Processing of Coal and Its Potential for Power Generation using High Ash Coal' by Shri K.T.U. Malliah, General Manager, BHEL, Tiruchirapalli, traced the development of fluid bed combustion abroad and in India. BHEL has designs up to 30 MWe FBC based on bubbling bed and so far contracted 26 FBC units ranging from 1.5 to 95 tonnes/h of steam. It dealt with CFBC technology and described the 1 m<sup>2</sup> CFBC set up in Tiruchirapalli. The developments on PFBC and fluidized bed gasification for combined cycle power generation were also referred. The 6 tonne/d PFBC unit of BHEL was described. The paper suggested that exiting 30-60 MWe power plants may be retrofitted with IGCC technology.

In his paper, Shri P.P. Arvind of Administrative Staff College of India, Hyderabad, dealt with the policy matters on environmental management, pointing out the need for integrating economic and environmental policies. An analysis done by him showed that environmental costs for power generation are 2.19 p/kWh and desirable environmental project costs are about 11 p/kWh which include FGD and coal beneficiation.

Each presentation of the paper was followed by discussion.

The workshop was attended by 170 delegates from R&D institutions, BHEL, CEA, State Electricity Boards and Engineering organizations. The delegates were shown round the coal pilot plants of BHEL and IICT in the Moula Ali campus.

The workshop included a panel discussion and based on the discussion at this session, the following recommendations were made:

1. As electricity is essential for the industrial and economic development of the country and as coal is the country's largest fossil fuel resource, expedient measures are required to be adopted to deal with the problems relating to the use of high ash coal to meet local requirements and the technological and environmental needs.

2. Prospects of using the country's low grade coal for power generation more efficiently and satisfying the minimum environmental regulations with regard to SO<sub>2</sub>, NO<sub>x</sub> and particulate matter are bright. Such systems like IGCC, PFBC, CFBC, etc. should be developed to suit the local conditions. These systems will also help reduce CO<sub>2</sub> emission which is one of the causes for the green house effect.

3. As Indian coals have high ash content and future projections with regard to quality of coal indicate ash content around 45% or even more, thermal power plants should be designed to suit such coal. While planning such power plants, integrated infrastructural development for the coal mines and transport should get due importance.

4. In order to improve the PLF and availability of the existing pulverized coal-fired boilers, pit head plants for preparation of coal like deshaling should be set up. This will result in supply of coal of uniform size and also in considerable saving in transport costs.

5. Efforts should be made to get more power from the existing plants by improving PLF by R&M, better load management and increasing efficiencies by suitable measures like training of man power and good O&M practices.

6. The old coal-fired boilers which have to be phased out should be retrofitted with improved systems like fluid bed combustors. Installation of small plants based on bubbling fluid bed combustion technology in remote areas should be studied for adoption to avoid long and costly transmission network.

7. As fly ash is causing a serious disposal problem particularly in view of the high ash content of coal, available technologies for making bricks, concrete blocks, pozzolonic cement and for road laying and reclamation of low lying areas should be utilized with suitable incentives. New technologies should also be developed.

8. As sulphur content in Indian coal is comparatively low, pollution due to SO<sub>2</sub> is not a cause of concern at present. However, while designing future power plants, suitable provision for space should be made for the installation of FGD plants at a later date when required.

For future thermal power plants, design should result in low NO<sub>x</sub> emissions.

9. In the long range, improved systems of power generation will be required to be adopted to improve efficiency, to cut down water requirement and to reduce emissions. Systems like IGCC, PFBC, etc. should be developed on a demonstration scale level to suit high ash coal. This will enable the country to design such plants in a decade or so. Economics should not be the prime factor while setting up such demonstration plants. These plants will help the country to gain valuable experience, train personnel and gather useful data. Such experience is not available abroad with low-grade high ash coal. These demonstration plants can be set up in a phased manner using the existing facilities in some

locations for coal handling, water supply, etc.

10. To meet the challenge of using low-grade high ash coal efficiently and in an environmentally

sound manner for power generation, an integrated R&D programme of developing improved systems should be initiated involving coal and power technologists.

environmentalists, planners and others. For such a programme, all support should be provided, including funds for the setting up of demonstration/pilot scale plants□

### CSIR Golden Jubilee Lecture

## Natural Science and The Indian Cultural Tradition

As a part of its Golden Jubilee Celebrations, CSIR is organizing a series of twelve distinguished lectures, called 'CSIR Golden Jubilee Lectures'. The first lecture of the series was delivered by Prof. Debiprasad Chattopadhyaya on 'Natural Science and The Indian Cultural Tradition', at IIT-Delhi on 22 November 1991.

Prof. Chattopadhyaya in his lecture emphasized the relevance of studying the development of science in the ancient era. Though more work on science got done in the last 50 years than perhaps in the past more than 2000 years, it is from the past that we can learn about the factors responsible for suppression of the progress of science. India could relapse into a 'stone age' if the processes that frustrated the growth of science in the ancient era are allowed to revitalize, warned Prof. Chattopadhyaya.

Indian science can be regarded older than Greek science — the Indian 'Uddalaka Asruni' of seventh or eighth century BC made major contribution to the scientific thinking long before Thales of Greece. The regression of science in India started around fifth century AD, but the beginning of the suppression of science in the country dates much earlier, to the era of 'Yajurveda', around 1100 BC.

The Yajurveda says, "Brahmins must never practice medicine because it is unclean". In the Rigveda, the science of human cure is idolized — in fact medicine is represented by two gods.

The traditional Indian Society was divided into various castes, the ideological basis of the division based on the 'past actions' or 'karma'. Since in practice of medicine, there was no mention of karma, the doctors were then the only scientists who defied the superstition and orthodoxy, and continued their work keeping four factors in mind: knowledge of medicine, cleanliness, mental courage and compassion for the patient. As they had to mix with all kinds of people in the course of their practice, the custodians of orthodoxy and superstition held the doctors in low esteem.

In the eleventh century, Prof. Chattopadhyaya said, we had a remarkable scientist who visited India, and through whom we can differentiate between 'science' and 'non-science'. A scholar in Greek, Persian and Sanskrit, Al-Beruni had an open mind. Though a staunch Muslim, he was not a fanatic or a fundamentalist, and quoted from *Bhagvat Gita* in his work.

Attracted by the Indian astronomical literature, he admired Varahamihira immensely. Varahamihira clearly described the solar and lunar eclipses. Al-Beruni considered Brahmagupta as the greatest astronomer of India — who made meticulous calculations on the eclipses. But when superstition and obscurantism become very strong one way perhaps is to give in! To please the custodians of religion, Brahmagupta gave support to orthodox thoughts though

not believing them. In the first chapter of his classical work he says that eclipses are caused by demons, but in the later chapters he sounds highly scientific and provides mathematical conclusions.

It was not only in India that the development of science was suppressed. Parallels can be found in China where major technological contributions like gunpowder and printing technology remained unexploited.

Citing examples from Greece and Italy, Prof. Chattopadhyaya said that Socrates was accused of 'corruption of the youth' and 'neglect of the gods whom the city worships and practice of religious novelties'. As a brave and honest person, he treated the charge with contempt and made a 'defence'. He accepted the chalice of hemlock with a smiling face rather than compromise! Galileo on the other hand tried to placate the clergy, though he denounced the very foundation of superstition. His earlier works were met with great criticism which made him frustrated. But later he wrote to Pope and got the permission to write 'as long as he discussed his findings noncommittally'. His book *Dove ne i congressi di quattro giornate si discorre sopra i due massimi sistemi del mondo tolemaico e copernicano* (Dialogue Concerning the Two Chief World Systems — Ptolemaic and Copernican), published in 1632 with full imprimatur of censors, did not face hostility

and was greeted with great enthusiasm.

Science by itself is not harmful but it has been used at times to meet the sinister goals of a few, making the scientists frustrated, said Prof. Chattopadhyaya citing the example of destruction of Hiroshima and Nagasaki by the use of atom bombs. □

## **Bio-hydrometallurgical processing of copper ores**

The production of copper in the country is quite less in comparison to its demand; in 1989-90, only 55,400 tonnes of the metal was produced against a demand of 1,35,000 tonnes. The Hindustan Copper Limited is the major producer of copper in the country. Its Malanjkhand copper mine generates large quantities of oxidized/semi-oxidized ore and lean sulphide ores of copper which are not suitable for the existing copper smelter.

To explore the commercial viability of a bio-hydrometallurgical route for treating the ore, HCL sought consultancy from the Regional Research Laboratory (RRL), Bhubaneswar. The aim was to recover copper from Malanjkhand sulphide ores through column leaching (bacterial), solvent extraction and electrowinning.

The bacterial solution generated in the 200 litre bacterial film oxidation unit (BACFOX) was used to leach 6-8" size 3 tonnes of Malanjkhand sulphide ore containing 0.2% copper, in an FRP column having 1 m diameter and 3 m height. The leach liquor containing 0.5 g/litre copper was processed through a continuous solvent extraction and electrowinning (6 litre/h) steps. The copper recovered was of 99.9% purity. The

project has been completed at a cost of Rs 0.28 million and the report submitted.

The report describes the results of experimental work carried out to optimize conditions for bacterial leaching of the ore, solvent extraction, electrowinning of copper and regeneration of leaching medium. A process flow-sheet along with the equipment flow diagram has been proposed. HCL is likely to apply this process at its Malanjkhand mine site. When the plant comes up it would be the first of its kind in India. □

## **R & D Programme on Plasma at RRL-Bhubaneswar**

Plasma has now been recognized as one of the efficient technologies in metallurgy, chemical engineering, physics, materials science and space science. Thermal plasma, which is mostly produced by arc and has different modifications such as torch, plasmatron, etc. which operate in the temperature range 2000-15000 K, is now an established technology to increase productivity while reducing processing cost. It enjoys several advantages over conventional heating methods: availability of high temperature and high energy density, enhanced reaction kinetics, fast quenching rate, control over oxidizing/reducing atmosphere, greater throughput, low capital investment and less pollution. Besides the thermal plasma, RF plasma plays an important role in processing high purity materials (for electronics, optoelectronics, laser, etc.) as it obviates the contamination owing to electrodes and crucibles.

Some examples where plasma technology can be used advantageously are:

*Beneficiation of Minerals:* Complex

minerals like rhodonite, ilmenite, beryl, euxenite and zircon are easily dissociated to mixtures of different primary oxides through thermal dissociation of plasma.

*Smelting, Melting and Refining:* Ferro alloys can be processed by direct smelting of their respective ore fines without agglomeration, utilizing carbothermic reduction. Clean and controlled environment in plasma furnaces result in minimum loss of alloying elements like Mn, Mo and Mg, permitting strict control on composition of wide variety of steels. It is possible to purify highly oxidizable elements like Ta and Ti by plasma melting and refining. The quality of these metals is comparable to or sometimes even better than the metals produced by vacuum induction melting and electron beam melting. Preparation of nitrogen enriched Fe-Cr and steel is easily feasible in thermal plasma as the solubility of nitrogen in the metal increases in plasma many fold, sometimes even by 100 times.

*Chemical Synthesis:* Chemicals like MgO catalyst, hydrogen peroxide, halocarbons, thixotropic silica, TiO<sub>2</sub> pigment and gases like ozone, acetylene, ethylene and nitrogen oxides can be synthesized by plasma and in many cases these processes work out to be cheaper than the conventional ones. Thermoplastic, thermo-setting polymers, high temperature or photosensitive polymers, polymer membranes for ion separation, fibres, conducting and superconducting polymers are prepared by plasma polymerization using RF plasma.

*Ceramics:* Refractory oxides, carbides, nitrides and oxynitrides are used in preparation of sintered products and in coatings by plasma spray of powders. Structural refractories like alumina, zirconia and other refractory oxides, carbides and nitrides can be



Regional Research Laboratory, Bhubaneswar, has carried out studies to recover copper from Malankhand sulphide ores through the bio-hydrometallurgical route, for the Hindustan Copper Limited (p.291). Shown here are column leaching and solvent extraction - electrowinning units.



spheridized with desired structural modifications by heat affection in thermal plasma for a wide range of applications. Powders produced by condensation of vapour (produced by plasma) have larger surface areas and show particle size in the submicron range.

The Special Materials Division of the Regional Research Laboratory (RRL), Bhubaneswar, has been pursuing an R & D programme on plasma for the last five years. The Division has indigenously developed different

types of extended arc (dc) plasma reactors for smelting ore fines, melting and refining of metals, synthesis of carbides, dissociation of zircon, stabilization of zirconia, toughening of zirconia and alumina, etc. A new facility for 120 kVA dc reactor fitted with plasma torch is being created. It is planned to prepare nitrogen enriched Fe-Cr, nitrogen steel, high pure tantalum, Fe-Ti, Fe-Mo using the above torch type reactor. A versatile RF plasma reactor (100 W) has been installed for synthesis of different com-

pounds and polymers and their deposition in thin film forms. □

### **Red Pigment from Waste Iron Chloride**

The Regional Research Laboratory (RRL), Bhubaneswar, has an R & D programme on the utilization of waste iron chloride from metallurgical and metal industries as well as iron scrap from workshops. One of the important products that can be obtained by treating iron chloride is the red oxide of iron.



When iron scrap is used, it is first dissolved in commercial or waste hydrochloric acid to obtain iron (II) chloride. A good quality black oxide is then prepared and roasted to get the red oxide.

Iron oxide black itself is a saleable and key intermediate as its quality has a direct bearing on the quality of the red oxide. Basic work carried out at RRL-Bhubaneswar has established that a good quality black oxide can be obtained by the oxidation of iron (II) hydroxide produced by the addition of various alkalies to iron chloride solution. Although conditions have been specified for a number of alkalies,

lime is preferred due to economic viability. The complete recovery of the byproduct calcium chloride makes the process pollution-free.

The process know-how referred to NRDC for commercial exploitation has been released so far to five parties; M/s Indian Chemical Industries, Aligarh; M/s Rohit Chemical and Allied Industries, Sallewal (H.P.); M/s Oriental Agency, Berhampur; M/s Colabo Chemicals, Hyderabad and M/s Feres Chemicals, Theni (Tamil Nadu).

The process details have been patented (Indian Patent Nos 143745 and NF/26/89). □

### Development of Synthetic Drugs: CSIR Technology Award winning Contributions of ICT

Dr A.V. Rama Rao, Dr M.M. Gurjar and Dr M.N. Deshmukh of the Indian Institute of Chemical Technology (IICT), Hyderabad, have been selected for the CSIR Technology Award (1991) for the development of synthetic drugs.

These scientists have developed several innovative and cost effective technologies for the essential drugs which include Etoposide (anticancer), AZT (anti-AIDS), S-Timolol maleate (anti-glaucoma), Omeprazole (anti-ulcer), Astemizole (anti-histaminic), Gemfibrozil (anti-cholesterol), Norfloxacin and Ciprofloxacin (anti-bacterial). The scientists have developed the first

chiral technology in the country for the anti-glaucoma drug S-timolol maleate starting from sugar. S-Timolol is now manufactured by FDC-Bombay, based on ICT technology and is also exported to other countries.

They have also developed the technologies for the anti-bacterial quinolones, Norfloxacin and Ciprofloxacin. These are the best broad-spectrum antibiotics now manufactured in the country by M/s CIPLA, Bombay. The technology for the latest anti-ulcer drug Omeprazole, possessing distinctive superiority and advantages over Ranitidine and Cimetidine, was also developed by them. The current

price of Omeprazole is Rs 2 lakh/kg.

In addition, Gemfibrozil, a potent anti-cholesterostatic drug is now being manufactured by M/s CADILA, based on the technology developed by these scientists. They have also developed a process for an anti-histaminic drug Astemizole which is ready for commercialization. □

### CSIR Young Scientist Award-winning Contributions of Dr Ahmed Kamal and Dr T. K. Chakraborty

Dr Ahmed Kamal and Dr T.K. Chakraborty of the Indian Institute of Chemical Technology (IICT), Hyderabad, have been awarded CSIR Young Scientist Award in Chemical Sciences for the year 1991.

#### Dr Ahmed Kamal

Dr Ahmed Kamal, after graduating from the Osmania University and obtaining Master's degree in Organic Chemistry from the Aligarh Muslim University in 1977, worked as a CSIR research fellow for his Ph.D. degree and obtained M.Phil and Ph.D. degrees in 1979 and 1982 respectively from AMU. In 1983, he joined IICT, Hyderabad, as a Scientist in Organic Chemistry Division.

Dr Kamal's research work has been mainly in the bioorganic chemistry and biotechnology areas, i.e. enzymes as biocatalysts in organic synthesis and drug design by receptor fit. His earlier contributions related to the development of new methodologies for the synthesis of biologically important compounds. He was awarded the Young Muslim Scientist Award (1988) by the Muslim Association for the Advancement of Science. In 1989, Dr Kamal did his postdoctoral research work in the



Dr M.N. Deshmukh



Dr M.M. Gurjar



Dr A.V. Rama Rao



field of bioorganic chemistry in U.K.

Enzyme catalyzed processes when compared to chemical methods often offer significant advantages over conventional reaction techniques, such as efficiency, regio- and enantioselectivity. Dr Kamal has successfully employed enzymes as biocatalysts for the first time in the cyclization of labile functionalized substrates, novel enzymatic cyclizations, catalase-mediated cyclizations, enzymatic deprotection methodologies, enzymatic oxidative conversion of thio to oxo, enzymatic enantioselective ring-opening of epoxides and biotransformations. This exciting and challenging area of research has considerable potential in the biotechnological development. He is currently working on several enzyme-mediated chemical transformations.

Recently, molecular recognition of DNA has made spectacular advances. As such, small molecules could now be designed as ligands that recognize particular sequences of base pairs on a strand of DNA. This may lead to new therapies for genetic diseases, some kinds of cancer and furthermore, as probes of DNA structure. During his studies on interaction of tricyclic compounds with DNA, Dr Kamal has investigated for the first time the nature of secondary interactions which are considered to be crucial for recognition of particular sequences of DNA prior to covalent attachment.

Presently, he is engaged in the design and synthesis of sequence-selective DNA binding ligands as potential anti-cancer agents in collaboration with the School of Pharmacy and Biomedical Sciences, Portsmouth Polytechnic, UK, under the British Council-CSIR Link Programme.

#### Dr T.K. Chakraborty

Dr Chakraborty did his Ph.D. work under the guidance of Prof. S. Chandrasekaran at IIT-Kanpur, and obtained the degree in 1984. Thereafter he went to work with Prof. K.C. Nicolaou at the University of Pennsylvania, Philadelphia, USA. His work there led to the successful completion of the total synthesis of polyenic macrolide Amphotericin B — one of the most complex molecules synthesized so far.

On his return from USA, he joined IICT in 1987, and within a very short span of time he has made significant contributions to many areas like organosilanes, macrolides, immunosuppressive agents, glycopeptides and other



cyclic peptides, synthetic peptide vaccines and total synthesis of various other biologically active natural products.

**Organosilanes:** A highly innovative work on organosilanes has been initiated by him. Temporary incorporation of silyl group as dummy substituent on epoxy ring ensures high regioselectivity

in the ring opening of 2,3-epoxy alcohols with azide ion. 'Substrate controlled' regioselectivity has been achieved, for the first time, in the epoxide ring opening which gives an easy access to many multifunctionalized chiral molecules, specially chiral amino alcohols, amino acids and hydroxy amino acids. This is an extension of his earlier work on the syntheses of all possible stereoisomers of  $\beta$ -hydroxy- $\alpha$ -amino acids, which has led to a total synthesis of MeBmt, the unusual component of immunosuppressant cyclosporine.

**Immunosuppressant FK-506:** In the continuing search for new immunosuppressive agents no other compound has evoked so much interest as FK-506, a novel 23-membered bicyclic macrolide. A formidable task undertaken by him to synthesize this structurally complex molecule having 14 chiral centres is nearing completion.

**Glycopeptide Antibiotic Vancomycin:** A major project has been undertaken recently to synthesize glycopeptide antibiotic vancomycin and other members of this family. Used widely in the treatment of staphylococcal infections, these compounds express their antibiotic activity by inhibiting bacterial cell wall biosynthesis by selectively binding to the C-terminal D-Ala-D-Ala residues of peptidoglycan precursors. Though these compounds are known for over thirty years, their synthesis has not been reported so far because of their complex structures.

Novel methodologies for the construction of bisaryl ether and biphenyl moieties present in this family of compounds have now been developed. An efficient method to synthesize chiral  $\alpha$ -amino acids, specially  $\alpha$ -aryl glycines, present abundantly in these glycopeptides, has also been developed based on diastereoselective Strecker synthesis using  $\alpha$ -

phenyl glycinol as chiral auxiliary. Easy availability of this chiral auxiliary in both enantiomeric forms allows the synthesis of L- as well as nonproteogenic D- amino acids in multigram quantities. Besides, easy removal of this chiral auxiliary by oxidative cleavage makes it an ideal choice for the synthesis of very sensitive  $\alpha$ -amino acids. The methods developed have also been successfully applied in the synthesis of structurally similar K-13, a highly potent non-competitive inhibitor of angiotensin converting enzyme.

**Protein Phosphatase Inhibitor, Nodularin:** Work has been initiated on the total synthesis of cyclic pentapeptide nodularin, toxin produced by cyanobacteria. This also has been found to be potent protein phosphatase inhibitor. A novel pathway has been developed for the synthesis of ADDA, a unique C-20 amino acid of this molecule, which involves the construction of all the four chiral centres present in ADDA from a single chiral epoxy alcohol. The same concept has been extended to the synthesis of Ahda, a novel  $\beta$ -amino acid of Scytonemin A, possessing potent calcium antagonistic properties.

**HIV-1 (AIDS) Protease Inhibitor:** Human Immunodeficiency (AIDS) virus type-1, HIV-1, attacks body cells by binding to CD<sub>4</sub>, the surface glycoprotein found on a subset of T-lymphocytes. The binding takes place through the envelope glycoprotein gp120 of HIV-1. Studies directed towards the inhibition of binding of gp 120 to CD<sub>4</sub> will help to arrest the infection of body cells by AIDS-virus. Work has been initiated to study the binding of small peptides to the 403-421 segment of gp-120. There is another way, of inhibiting the replication of HIV-1. The gag and pol genes of HIV-1 are translated as two polypeptides which are subsequently cleaved by HIV-1

protease to structural proteins of the virus core essential for retrovirus replication. Effective inhibition of HIV-1 protease involves replacement of scissile dipeptide of an oligopeptide substrate with nonhydrolyzable synthetic hydroxy ethylene or dihydroxyethylene isosteres which act as transition state analogue and mimic the tetrahedral intermediate formed during the enzyme-catalyzed hydrolysis of the peptide bond. An efficient methodology has been developed for the construction of very useful hydroxyethylene isostere amino acid analogues starting from, for the first time, a carbohydrate precursor, and has been applied for

the synthesis of Boc-Phe  $\Psi$ [CH(OBn)CH<sub>2</sub>]Gly, the hydroxyethylene isosteric moiety of potent HIV-1 protease inhibitor.

**Synthetic Peptide Vaccines:** Studies have been initiated on the synthetic peptide vaccines. Work on the synthesis of 137-160 segment of VP 1 protein of A22 strain of foot and mouth disease virus is currently under progress.

**Timolol Maleate:** The technology for  $\beta$ -adrenergic antagonist timolol maleate used for the treatment of eye-disease glaucoma has been developed as a stepping stone to make IICT the leading institute in India in the field of chiral drugs. □

## BUILD TECH'91 - National Seminar on Recent Developments in Building Materials & Construction Technology for Quality, Speed and Economy

The Central Building Research Institute (CBRI), Roorkee, organized the two-day national seminar 'BUILD TECH'91', jointly with SVS Consultant, Hyderabad, in Hyderabad, during 10-11 October 1991. More than 100 delegates representing various government, semi-government, autonomous, public and private organizations participated.

Speaking at the inaugural function, Smt. Kumud Ben Joshi (former Governor of A.P.) and Shri Janardhan Reddy, Minister for Labour, Employment and Housing, Government of Andhra Pradesh, stressed on the need to work for Science & Technology delivery and participation. They said that this aspect must receive joint attention of those who in some or the other way tend to be a link between the laboratory and the intended user.

The seminar consisted of following six technical sessions: Construction techniques; Comfort, safety and maintenance; Building

industries and Housing finance; Building materials; Mass building projects case studies; and Feedback studies throughout India of projects having utilized CBRI processes/techniques/systems.

The valedictory function, co-chaired by Dr K. Keswa Rao, Chairman, Rajiv Gandhi Technology Mission for Rural Poor and Shri B.N. Reddy, ex-M.P., stressed upon a dire necessity for going into the transfer mechanism which is not understood by the majority of those involved in this sector. □

## NEW PUBLICATIONS

### Mining the Ocean

Mysterious, unforgiving, bountiful, capricious and unpredictable, oceans have fascinated man through the ages. The songs of the waves and the lure of adventure have exerted powerful influence on the future of nations and mankind.

Now, as never before, the oceans are yielding their secrets. Rich repositories of valuable metals are part of the marine treasure trove awaiting retrieval. From salt to gold, from petroleum to uranium, the cornucopia of the seas overflows.

This attractive and lavishly illustrated book, second in the series of popular science books for children being brought by CSIR (PID) in the Council's Golden Jubilee Year, reveals the timeless secrets of the seas. It unfolds in exquisite detail the bounty that seas hold in reserve, and highlights man's attempts at mining the oceans.

The book (author: T.K.S. Murthy, Price: Rs 12) can be had from: The Sales & Distribution Officer, PID, Dr K.S. Krishnan Marg, New Delhi 110012.

### CECRI - Memoirs 1990

The Central Electrochemical Research Institute (CECRI), Karaikudi, has brought out the publication 'Memoirs 1990' which contains abstracts of the papers published during 1990 in the CECRI journal *Bulletin of Electrochemistry*, and also the abstracts of the research reports of the CECRI scientists, published in journals like *Journal of Electrochemical Society*, *Journal of Metals*, *Journal of Applied Electrochemistry*, *Tools & Alloy Steels*, *Talanta* and *International Journal of Hydrogen Energy*.

For copies of the above publication, please write to: The Director, CECRI, Karaikudi 623006. □

### Honours & Awards

#### Dr R. Subba Rao

Dr R. Subba Rao, Head, Oils and Fats Division, Indian Institute of Chemical Technology (IICT), Hyderabad, has won the Dr S.

Husain Zaheer Memorial Award 1990 of the Oil Technologists' Association of India (OTAI) for his excellent work on reactions of unsaturated fatty acid methylesters, studies on preparation and analysis of dimer acid esters and synthesis of some important chemicals.

#### Dr T.N.B. Kaimal & Ms M. Saroja

Dr T.N.B. Kaimal and Ms M. Saroja of the Oils and Fats Division, IICT-Hyderabad, have won the G.S. Nevatia Memorial Award 1990 of the Oil Technologists' Association of India (OTAI) for the best paper published in all issues of the Journal of OTAI, which appeared during the previous calendar year.

#### Dr R.S. Balakrishna

Dr R.S. Balakrishna of the Organic Coatings and Polymers Division, IICT-Hyderabad, has been awarded the R.B.G.V. Swaika Memorial Award 1990 by the Oil Technologists' Association of India (OTAI) for his excellent work on preparation and synthesis of binders/coatings suitable for electrodeposition, their performance and evaluation, using indigenously available raw materials namely vegetable oils, cardanol, etc.

#### Dr M.K. Gurjar

Dr M.K. Gurjar of the Organic Chemistry III Division, IICT-Hyderabad, has been nominated as a Member to the International Carbohydrate Organisation (ICO), to represent India in the most prestigious body of Carbohydrate Chemists. □

### PATENTS FILED

477/DEL/91: An improved device for manufacturing metal matrix composites by liquid metallurgy technique and a process therefor,

T.R. Ramamohan, B.C. Pai, K.G. Satyanarayana and A.D. Damodaran—Regional Research Laboratory, Trivandrum. □

### NOMINATIONS INVITED

#### CSIR Young Scientist Awards: 1992

Nominations are invited by the Council of Scientific & Industrial Research for the 1992 CSIR Young Scientist Awards. The awards are to be given for research contributions made primarily in India during the past five years. The age of nominees should not be more than 35 years as on 26 September 1991. Regularly employed scientists working in CSIR system are eligible for consideration.

The awards, each of the value of Rs 10,000, are given annually for notable and outstanding research, applied or fundamental, in the following disciplines: (1) Biological Sciences, (2) Chemical Sciences, (3) Earth, Atmosphere, Ocean and Planetary Sciences, (4) Engineering Sciences and (5) Physical Sciences (including instrumentation).

Nominations should be sent as per the prescribed pro forma (20 copies) by registered post, giving statement of work and attainments of each nominee. The attainments of the nominee during the past five years may be highlighted and sent along with one set of reprints of research papers published during the 5-year period. Nominations signed by the sponsors should be sent marked 'confidential' to the Head, Human Resource Development Group, Extramural Research, CSIR Complex, Pusa, New Delhi 110012, by 31 January 1992. Regulations governing the prize and the pro forma for nomination may be obtained from the above address. □

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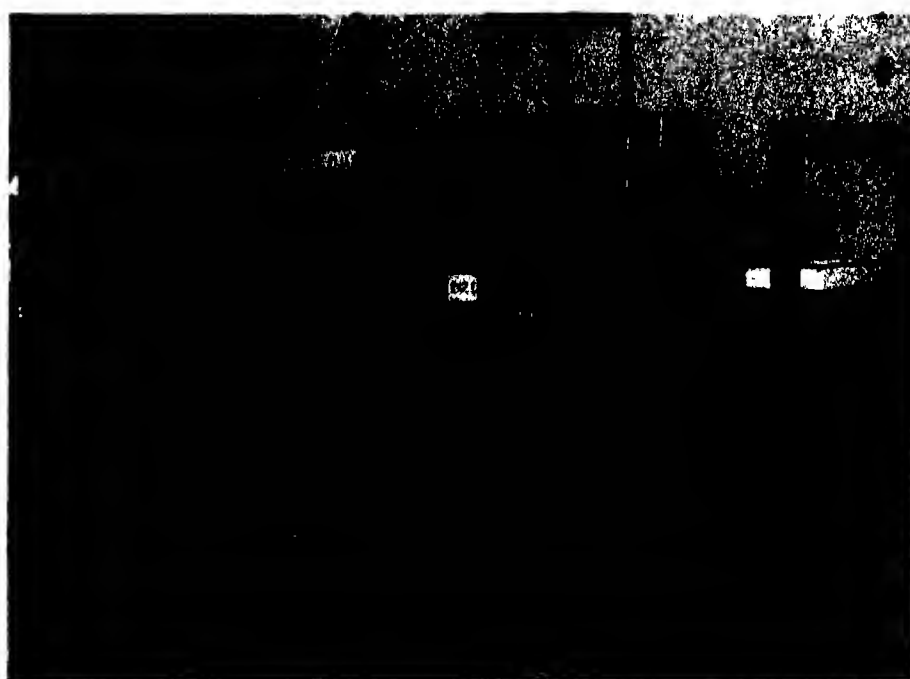
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# CSIR NEWS

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Microplot set-up for production of Zeolite A, a detergent builder, from kaolin (left), and rotary kiln reactor for ilmenite reduction at the Regional Research Laboratory, Trivandrum. A report on the R&D activities of the laboratory during the year 1990 appears on p.298.

## REGIONAL RESEARCH LABORATORY, TRIVANDRUM

### R & D Highlights: 1990

The major R&D activities of the Regional Research Laboratory (RRL), Trivandrum, relate to: Production/processing of oil palm, coconut cream and spices; Biological methods of insect control; Production of alcohol through fermentation of carbohydrates; Wastewater treatment; Superconductivity; Advanced Al-matrix composites; Extraction of rare earths; Production of synthetic rutile from ilmenite; Value-added products from clays; Speciality polymers and Photochemistry. A brief account of the significant R&D attainments of the laboratory during 1990 is presented here:

Oil palm, in the years to come, will be a major source of edible oil in India since massive efforts are being made to develop oil palm plantations in Andhra Pradesh, Karnataka and Maharashtra. RRL-Trivandrum is a pioneer institution in the country, which has developed expertise and infrastructure to provide S&T support to oil palm development. The laboratory had earlier set up a demonstration plant at ICAR-Palode for raw palm oil extraction, with a capacity to process 1 tonne FFB/h. The plant is operational with an efficiency and product quality comparable to that found elsewhere. After the successful demonstration of the plant, the laboratory entered into an agreement with the Andhra Pradesh Cooperative Oil Seeds Growers Federation for the establishment of the first indigenous, commercial palm oil mill in West Godavari District of Andhra Pradesh. Several modifications have been incorporated in the design of the mill for better operational ease and efficiency on the basis of the ex-

perience gained from the demonstration plant. The mill is being set up and is expected to be commissioned soon.

With a view to developing a dry fractionation technique for the separation of palmolein fraction from crude palm oil, 2-4.5 kg batch trials were made with and without the addition of 0.1% palm kernel oil, and using a cryostat. The optimum temperature and holding time were found to be  $27 \pm 1^\circ\text{C}$  and 4-5 h, respectively. Stirring was done at 500 rpm. The yield of palmolein fraction was found to be 65-75% and 50-55% for the treated and untreated batches, respectively.

Physico-chemical and biochemical investigations on oil palm related to: Ultrastructure studies on oleosomes (fat storage subcellular organelles) of oil palm fruit mesocarp, using transmission electron microscope; Localization of glyoxysomes in the germinating oil palm seed during embryogenesis; Assay of key enzymes of glyoxylate cycle in the germinating oil palm seed; Lipid profile of mesocarp and exocarp of three varieties of oil palm fruit (Dura, Pisifera and Tenera); Lipid composition during palm fruit development and Distribution of pigments in oil palm fruit during development.

The demonstration plant for coconut cream, being set up at the Kalamasserry Industrial Estate in Cochin, is a full-fledged pilot plant with a capacity to process 1000 nuts/shift. The activities during the year comprised completion of the plant building, design and fabrication of additional equipment, its installation and carrying out of trial runs. During the plant

trials, it was observed that sterilization of canned coconut cream in a stationary retort at 20 psi for 15 min (optimum time and temperature required to prevent microbial spoilage) affected the quality of the product adversely. Rolling the cans while sterilization facilitates faster heat penetration and distribution. A rotary retort, which can hold 600 cans of 204x301 size, was designed and fabricated for this purpose.

During germination of oil seeds, the utilization of lipid proceeds through glyoxylate cycle which converts acetyl CoA into oxaloacetate resulting in the synthesis of sucrose and other sugars. The mechanism of fat mobilization and metabolism could be different particularly in the case of coconut which has a highly developed functional haustorium formed only during germination. A detailed analysis for fat, sugar, proteins and non-protein nitrogen from the different regions of the germinating coconut endosperm collected during different stages of germination (starting from 8th week up to 20th week at 2-week intervals) was carried out. Studies on key enzymes of glyoxylate cycle in germinating coconut endosperm were also carried out.

Histochemical localization of catalase, the marker enzyme, was carried out in the germinating coconut endosperm along with other important constituents like fats and sugars. The studies showed catalase activity and high concentration of sugar in the outer part of the haustorium compared to other parts. The fat content was lower in the outer part showing that the coconut haustorium is actively involved in the biotransfor-



mation of lipids to sugars for the embryogenesis.

An innovative method, involving the use of microwaves, was developed to inactivate lipase enzyme present in oil palm fruits and rice bran, for which patents have been filed.

Under the Spices Programme, 18 major cultivars and three new genotypes were systematically analyzed for their quality characteristics. A technique for microencapsulation of oils and obsolescences was optimized. Microencapsulated spice flavours were made and supplied to the entrepreneurs for market evaluation.

Studies were made on the basic chemistry of terpenyl glycosides of cloves, non-saponifiable constituents of cardamom, constituents of a new leafy spice essential oil Vayana, and molecular complexation of ginger flavour. Encapsulation of fresh ginger aroma was tried using BCD based on the general principles of gas-liquid, liquid-liquid and solid-liquid complexation methods. Direct addition of hydro-distilled oil into saturated aqueous solution of BCD gave best results with respect to yield and quality of the product.

The laboratory continued its studies towards developing insect pheromones and antifeedants, under its programme on biorational insect control. The phytochemical investigation on *Piper* and *Mallotus* was continued, and crotopoxide was isolated from the berries of wild pepper, *Piper attenuatum* in good yields. Its antifeedant activity on Pollu beetle was observed to be: 50-60% inhibition at 100 ppm level and more than 90% inhibition at 200 ppm level. Further trials were in progress at NRCS, Calicut.

A four-step process was developed for the preparation of (2)-

3-dodecen-1-olE-2-butenate, the sex pheromone of sweet potato weevil. In response to the successful field trials carried out in collaboration with CTRI, Trivandrum, large scale preparation of the pheromone and development of its slow release formulation were undertaken.

The studies on high sugar fermentation with immobilized cells showed that immobilized cells can ferment very rapidly up to a concentration of 600g/l, converting all the sugars into alcohol in 24h duration. Based on these results two patents were filed.

The project on continuous fermentation of alcohol using cassava starch hydrolysate in a cell immobilized bioreactor was pursued and some of the defects observed during large-scale trials were rectified by modifying the reactor design.

A sponsored project funded by DBT to a tune of Rs 3.2 million was initiated. Under this project, strain improvement studies on bacillus were being pursued for preparing the CGTase enzyme.

The first full-scale plant based on the process developed at RRL for the treatment of wastewaters from natural rubber centrifuging factories was nearing completion at the factory site of M/s A.V. Thomas & Co. near Punalur, Kerala. The plant makes use of the activated sludge process to reduce the high BOD level of the wastewater.

The studies made by the laboratory on performance of the wastewater treatment plant at M/s Hindustan Latex Ltd, Trivandrum, revealed the need to add a deammoniation step to limit the free ammonia content to less than 2 mg/l. The sponsored programme of M/s Green Valley Chemicals, for generation of basic engineering data for the process to recover chemicals by treating effluents

from the sulphate plant reached the pilot plant demonstration level.

The laboratory is participating in the SQUID programme of CSIR, and is also studying the processing and fabrication of superconducting wires, coils and sheets, and basic aspects of superconductivity.

In the area of particulate ceramics, studies were made on boehmite sol derived alumina powders, preparation of aluminium titanate powders through sol-gel technique, alumina ceria composite powders through sol-gel decomposition and metal nitrate-urea decomposition technique, and tape casting of Pr doped zinc oxide varistors.

Under an RRL-BHEL programme on superconductor wires, citrate gel derived YBCO powder prepared at the laboratory was used to draw Ag clad wires at BHEL through 'powder in tube' method. Two batches of the powders sent were used for wires, and  $J_c$  as high as 1600A/cm<sup>2</sup> was obtained. This value is the highest ever reported in the country.

Work was continued on the development of high strength high modulus aluminium alloy matrix composites using indigenously available abrasive grade (SiCp) powder. Under a project on preparation of graphite dispersed aluminium alloy (LM6) matrix composites, the graphite distribution in cast cylindrical composite ingots was evaluated by qualitative metallographic technique. The results confirmed the earlier findings; a flow chart was developed for the synthesis of the composite.

Studies were continued to determine the beneficial effects of rare earth (RE) addition to commercial aluminium alloys and to establish the optimum amount of RE required during SG iron making.

As lanthanides have superior fluorescent, magnetic, optical and catalytic properties, demand for them is increasing. But similarities in their chemical nature make the mutual separation and purification of lanthanides a difficult task. The laboratory is working on the modelling of liquid-liquid extraction route for industrial separation of these rare earths, and on the large scale synthesis of HEP-EHP.

A process was being developed at the laboratory to produce synthetic rutile from ilmenite, based on direct reduction of ilmenite with coal followed by aeration leaching. The attractive features of the process are low pollution, better economic viability and ease of operability owing to the absence of acid leaching step. On the basis of results obtained during laboratory studies and micro pilot plant investigations, a joint proposal for setting up a 5 tonnes/day pilot plant was submitted to M/s Indian Rare Earths Ltd. Efforts were continuing

to develop the ilmenite direct reduction technology at pilot plant scale with the help of M/s Sponge Iron Ltd. Hyderabad.

Under a sponsored project of M/s Bharat Starch and Chemicals Ltd. on production of Zeolite A from the abundantly available china clay resources of Kerala, the laboratory carried out optimization studies of the different steps involved in the conversion of kaolin to Zeolite A, viz. aging, metakaolinization and crystallization. A report incorporating the results was submitted to the company which has signed an MoU with the M/S Kerala State Industrial Development Corporation for promoting a Rs 500 million project for the manufacture of Zeolite A.

For making coir-polymer composites, conditions were optimised and a demonstration plant was set up, under a project sponsored by the Coir Board. A large number of pannelings were being produced in

the demonstration plant for field trials.

Studies were made on inherently fire retardant polyurethanes and polyesters using functionalized cardanol. Synthesis of a series of bifunctional monomers of cardanol are envisaged for polyesters and polyurethanes. Synthesis of a few diazo coupled cardanol-aminophenol systems was being attempted.

The studies in the field of photochemistry were focussed on: phototransformations and mechanistic investigation of selected organic substrates, homogeneous and heterogeneous photoelectron transfer process and polymer chemistry. Polymerizable chromophores (S-acryloyl-1-O-ethylxanthate) were prepared and copolymerized with styrene/methylmethacrylate. Irradiation of these polymers in solution or as films led to efficient photocrosslinking. □

## INSTITUTE OF MICROBIAL TECHNOLOGY, CHANDIGARH

### R & D Highlights: 1990-91

The R & D activities of the Institute of Microbial Technology (IMTECH), Chandigarh, during the year 1990-91, under its various thrust area programmes were as follows:

**Development of site-specific drug delivery systems:** The institute is exploring the possibility of using the interactions between cell surface receptors and their ligands for delivering drugs to tumour cells selectively. The specificity and high efficiency of the 'scavenger-receptor' mediated endocytic pathway appear appropriate for this purpose. This receptor system recognizes polyanionic macromolecules such as maleylated bovine serum albumin (MBSA) and is present only

on the surface of cells of monocyte-macrophage lineage. After high affinity binding with cell surface receptors, MBSA is internalized and degraded in the lysosomes. IMTECH had earlier shown the feasibility of using MBSA as a carrier of drugs to macrophages both *in vitro* and *in vivo* for the elimination of intracellular microbial infections such as leishmaniasis and tuberculosis. It had also established that the scavenger receptors can modulate the intracellular concentration of the drug.

In the studies made during the year, the above rationale was extended for delivering drugs specifically to tumour cells of macrophage origin, for its eventual application

in the treatment of human diseases like histiocytic malignancies where the neoplastic cells belong to macrophage lineage. For this purpose, daunomycin (DNM) was coupled with MBSA by glutaraldehyde and the conjugate was subsequently purified by Sephadex G-50 column chromatography and extensive dialysis. Stoichiometric estimation revealed that 3-4 moles of DNM were coupled to each mole of protein. It was also shown that MBSA-DNM uptake by tumour macrophages follow saturation kinetics, suggesting that the conjugate is recognized by a limited number of binding sites on the cell surface. This high affinity binding leads to rapid internalization and degradation of the drug conjugate

in the lysosomes. Moreover, the degradation of the drug conjugate is inhibited by unlabelled MBSA, fucoidin, dextran sulphate, polyinosinic acid and polyguanylic acid, indicating that it is taken up by the cells through scavenger receptors which recognize these ligands. The results obtained also demonstrate that this conjugate is recognized only by the tumour cells of macrophage lineage and not by the non-macrophage tumour cells.

**Selective delivery of drugs to malaria infected erythrocytes:** With a view to developing a system for antibody-mediated selective delivery of cytotoxic compounds (antimalarial/hemolytic) to rodent malaria infected RBC, efforts were made to obtain antibodies specifically recognizing infected erythrocytes (iRBC) and to establish that the component(s) recognized are present on the surface of iRBC.

**Novel petroleum exploration strategies:** The objective of this project was to devise easy-to-use diagnostic probes capable of detecting the presence of hydrocarbon utilizing bacteria characteristic of oil bearing formations.

It was reported earlier that antibodies against two proteins (58 kDa and 42 kDa) isolated from Indian oil-field bacteria are very specific and react with cells grown only on propane or butane. These two proteins are constituent parts of a molecule of more than 300 kDa. Their presence in membrane as well as in the cytoplasmic fractions was shown by Western blotting. A 4.9 kb cloned genomic fragment was found to express the 58 kDa protein.

Since these two antibodies could detect all isolates capable of growing in propane and butane, it was of interest to see if these could be used to detect the presence of similar proteins in bacteria capable of growing only on butane and not

on propane. Western blotting using these two antibodies failed to detect the presence of a protein recognized by these antibodies both in the membrane as well as in the cytoplasmic fractions of such bacteria which are able to grow only on butane. This suggests that the protein involved in butane utilization in bacteria, which could utilize both propane and butane, is antigenically different from that present in bacteria which can grow on butane only.

To estimate the approximate molecular weight of the whole protein, cytoplasmic fractions (partially purified by DEAE-cellulose or crude) were passed through Sephacryl S-300, S-400 and S-500. Fractions giving positive reactions were always found in the void column suggesting that the native protein is larger than 500 kD in size or the protein assumes an aggregated form.

A simple method for direct spotting of soil suspension on nitrocellulose membrane and detection of hydrocarbon utilizing bacteria in the sample was standardized.

The 4.9 kb EcoRI fragment was mapped with respect to six restriction sites. Orientation of the insert in lambda *gill* was determined.

The whole fragment and subfragments were used as probes for detection of hydrocarbon utilizing bacteria. Among about 30 different bacteria tested, the probes showed strong positive hybridization only with the hydrocarbon utilizing bacteria. DNA probes, unlike immunological probes, showed positive hybridization with DNAs of hydrocarbon utilizing bacteria, irrespective of the growth substrate. Therefore, they may be useful for detecting particular types of microorganisms.

**Regulation of the immune system:** This project is intended to un-

derstand the role of the action of immunomodulators in order to develop specific immunopotentiators or suppressors.

Ovalbumin and KLH specific T-helper cell lines were established. Antigen specific virgin and memory B-cells were isolated and characterized. Functional processed antigens were isolated. Two non-IL-1 membrane-bound protein molecules of 135 kD and 97 kD were isolated from mouse peritoneal macrophages by SDS gel electrophoresis. These molecules induced the proliferation and differentiation of ovalbumin specific T-helper cells only in presence of isolated functional antigen-IA complex. It was demonstrated that these molecules also regulate T-dependent antigen-specific B-cell responses.

**Development of plasmid vectors for expressing cloned foreign genes in the yeast *S. cerevisiae*:** An attempt was made to construct a yeast strain which would retain plasmids under non-selective conditions, by introducing a null mutation in one of the essential genes of the yeast, and ensuring at the same time that this gene is present in a functional form on a plasmid harboured by the mutant. FUN 81 was the gene selected and to introduce a null mutant in FUN 81 gene by deletion disruption, the FUN 81 gene contained in a 5.7 kb yeast fragment was first subcloned into pUC 18, thus creating a plasmid pTKF3. Then a 1.83 kb *clal* fragment was deleted from pTKF3 and a 1.5 kb fragment containing kanamycin resistance gene from tn903 was introduced. The new plasmid thus created was named pTKF7 and it was introduced into the *S. cerevisiae* strain DJ 211 alongwith the plasmid pEDI and then scored for *ura*<sup>+</sup>, geneticin resistant colonies. Since pTKF7 cannot replicate in yeast, such

colonies would arise only if the kanamycin resistance gene gets inserted into FUN 81 in the chromosome by homologous recombination through the yeast sequences flanking the APH gene present in pTKF7, thereby creating a disruption deletion (null mutation) in the chromosomal FUN 81 gene. This way the two strains with putative null mutation in FUN 81 were constructed.

To convert the chimeric plasmid containing FUN 81 into a suitable expression vector, it was desired to clone the PGK promoter of yeast into the plasmid and then make it regulatable by bringing it under the control of lambda C1 repressor operator system. As a first step, the C1 repressor gene of the phage was cloned in the yeast vector YEP51 under the gal 10 promoter to obtain plasmid yC1. Expression of the C1 gene was confirmed by Western blotting and immunofluorescence studies with antibodies raised against C1 protein in rabbit. A plasmid carrying PGK promoter with an upstream (21 bp) C1 operator sequence and a downstream  $\beta$ -galactosidase reporter gene attached to it was introduced into the strain W 303-IB/p yC1. A 20-fold higher level of induction of  $\beta$ -galactosidase was obtained when the transformant was grown on glucose, instead of galactose, indicating that the C1 repressor operator system of phage in the experiment set up was fully functional in yeast and could regulate the PGK promoter.

A 21 mer operator sequence (ORI) was cloned in plasmid pMBL1 (a derivative of plasmid pMBL 216, constructed in IMTECH) in the pGK promoter and was introduced into *E. coli* NF1. The activity of the pGK promoter of yeast *S. cerevisiae* was found to be maximum at 30°C. The activity is controlled at the level of transcription. This was also found

to be true for URA3 and TRP1 genes in *E. coli*.

**Feasibility and optimization studies for fermentation processes:** Studies under this broad-based project are directed towards optimisation of fermentation conditions for: (a) the production of ethanol from molasses, using fed batch and continuous stirred tank reactors, and (b) rifamycin B to S conversion using soluble and immobilized rifamycin oxidase. The rifamycin B to S biotransformation process was demonstrated to another pharmaceutical company and an agreement was signed with the company for adoption of the process in its new rifamycin fermentation unit.

The Microbial Type Culture Collection Facility, jointly sponsored by the Department of Biotechnology and CSIR, experienced an increased demand of

its services by the community of microbiologists. During 1990-91, 576 requests for its services were fulfilled as against 239 in the previous year.

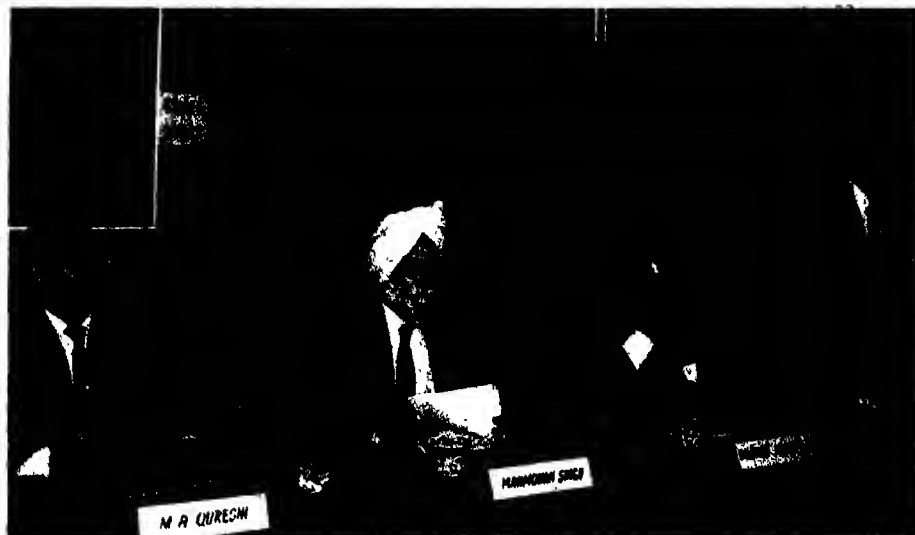
The Biochemical Engineering Research and Process Development Centre added a number of downstream processing capabilities to its repertoire. The Centre provided assistance to several industries as well as research organizations and universities. Collaborative work was undertaken with industrial organizations for commercialization of the know-hows for ethanol production and conversion of rifamycin B to rifamycin S.

The Distributed Information Centre on Bioinformatics consolidated its *modus operandi* and catered to a number of requests for bibliographic searches from the scientific community. □

## International Workshop on Human Centered Systems

An International Workshop on Human Centered Systems was held at the National Institute of Science, Technology and Development Studies (NISTADS), New

Delhi, during 18-20 November 1991. Inaugurated by Shri Pranab Mukherjee, Deputy Chairman, Planning Commission, the workshop came up as a part of the



Dr Ashok Jain delivering his address at the International Workshop on Human Centered Systems. Seated on the dais (from right) are: Shri Pranab Mukherjee, Shri Manmohan Singh and Shri M.A. Qureshi

research programmes at NISTADS, IITs and a number of universities in India and their continuing informal linkages, and also as a part of the research programmes of the International Network on Human Centered Systems. It was attended by over 60 participants from seven universities, three IITs and a few research centres from India. The foreign delegates were from six universities from UK, Germany, Italy and Japan and also from other research centres, some of which are exclusively industrial. Participants were from such diverse fields as computer science, cognitive science, mathematics, philosophy, economics, sociology, psychology, and political science. Many participants brought in their discussions references to traditional Indian theories, which enabled a discourse between modern logic, mathematics and computational theories, and both traditional and social theories.

Inaugurating the workshop, Shri Pranab Mukherjee endorsed the necessity of a cognitive transformation and a corresponding theorization. He emphasized that to enable contemporary computerization becoming a modern social and civilizational enterprise, what we need to do is to transform institutions, organizations and expectations of our people. To achieve this, a cognitive theorization is needed. What it calls for is something big, not just limited to computer hardware or software but aiming at the changeabilities of human mind, knowledge and its congealed forms as machines. Man and Machine thus appear together. Our future cannot be a copy of the experience of the industrial world, Shri Mukherjee remarked. But the future must ensure knowledge and well-being for the hundreds of millions in the rural India, in villages as well as in small towns.

Dr Ashok Jain, Director, NISTADS, in his welcome address dwelt on Jawaharlal Nehru's vision of an India with its teaming population knowledgeable and happy.

Shri Manmohan Singh, past President, Confederation of Engineering Industries, emphasized in his presidential remarks the need of Indian theories, culture and situations to be taken into account while working on computers.

Shri M.A. Qureshi, Scientist, NISTADS, proposed a vote of thanks at the inaugural session.

The three-day workshop was divided into six technical sessions and a plenary session. The six sessions were on: (1) Representation-structures on human and machine, (2) Reason and emotion—approaches to convivial work, (3) Facts and practical reasoning—organized limits to cognition and normation, (4) Advanced integrated manufacturing and the shaping of industrial cultures, (5) Economic innovation in the age of diversity, valorization, scope and networks, and (6) The culture of the artificial and the future of human society. Twenty-two research papers were presented in these sessions, and each of the presented papers dwelt on aspects relating to cognition. Representation and rationality, especially as considered phenomenologically and as demanded by computational requirements, remained a major point of debate. Human body and machine or any other artifact were considered together and compared from western and Indian theoretical vantages. Problems of action, especially moral action and knowing, in the presence of a statistically driven and reasoning computer, were presented, drawing upon Indian theoretical traditions. As an extension of this, reflected in western thinking on cognition, machine and freedom and or-

ganizations were also discussed in a number of papers. A few presentations discussed in detail the construction of rationality as economically and socially considered, or the concept of artificial and system when man-machine are considered together. A number of participants dwelt on the intricate details of man-machine interaction, such as on aspects of skill, on specified skill and dialogues, on dialogues, on story-answering, etc. Some speakers related these with general problems of institutions and organizations, on notions of skill and on global competitiveness and learning.

The plenary session, which was also the concluding session, dwelt on the debates relating to human-centeredness and the emerging need of theoretical tools necessary to comprehend the problems of cognition. Most of the speakers felt that the theorization of domain of cognition was needed, and in the absence of any such theory, research could only be piecemeal. The delegates from abroad deliberated on objectives of their studies especially as these related to the international network. Considering the Indian peculiarities, and also the absence of a reassuring theory, all the Indian participants agreed on two premises: (a) that a networking amongst these researchers was needed for theorization and exchange of ideas, and (b) that such a network should be preparatory to a research programme on cognitive theories. Dr Ashok Jain welcomed this proposal and offered the assistance of NISTADS in this regard. Appreciating the offer, the foreign delegates expressed their desire to maintain linkages with the proposed network. Shri P. Banerjee, Scientist, NISTADS and Convener of the workshop, proposed a vote of thanks. □



## National Conference on Synthetic Membranes and Their Applications

A National Conference on Synthetic Membranes & Their Applications [NACOSYMA] was held at the Central Salt & Marine Chemicals Research Institute (CSMCRI), Bhavnagar, during 29-30 November 1991.

The deliberations of the conference were divided in five technical sessions, viz. (1) polymer synthesis and membrane development; (2) desalination of brackish and sea water; (3) membranes in effluent treatment and pollution control; (4) membranes in chemical industry, separation, concentration and purification of chemicals; and (5) membranes in food and pharmaceutical industries, biotechnology and other applications. A total number of 41 invited papers from India and abroad were presented at the conference. Around 100 delegates participated. The technical sessions were followed by a concluding session where the following resolutions were adopted.

1. As the membrane processes are energy efficient, these should be developed to their fullest potential and employed in various industries. This calls for the immediate intensification of R&D input in the area of membrane science and technology. For this, there is an urgent need to allocate larger funds in this area. Governmental funding from DOD, DBT, DNES, DST, etc. for research institutions and universities is strongly recommended. Interested industries may institute scholarships/fellowships for the prosecution of research in the universities on topics of industrial importance. Industries may also sponsor, if they so desire, research in national laboratories in this area.

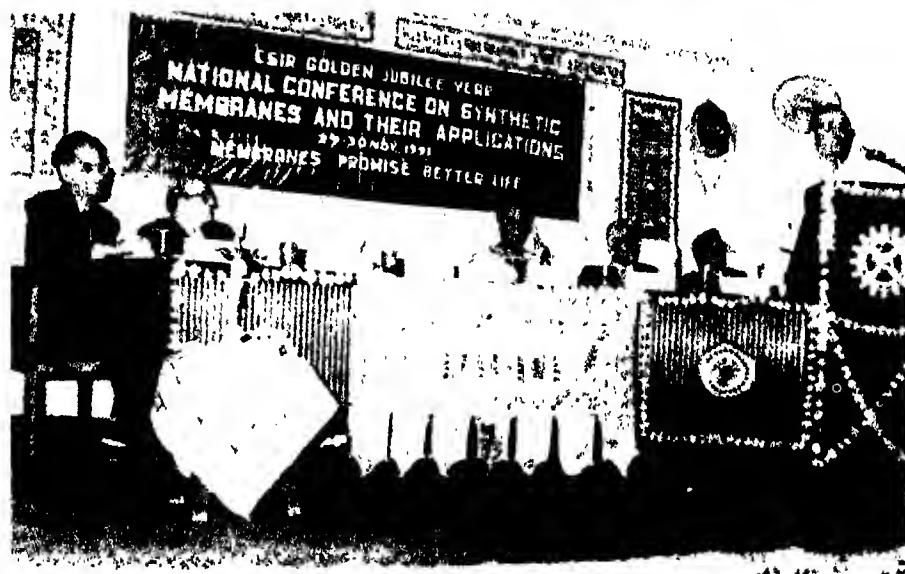
2. We have so far been contented with R&D on desalination by membranes. Research activities in the areas like pervaporation, membrane reactors, membrane sensors, ceramic membranes, gas separations, hybrid techniques, etc. have not yet been started or vigorously pursued. Research ac-

tivities in these areas should be commenced without delay.

3. Membrane science and technology is a vast area touching every aspect of human life. In order that it may flourish, expertise in physical, biological and engineering sciences has necessarily to be pooled. No less a person than Dr Sourirajan who was responsible for the emergence of Reverse Osmosis, had stressed the need to establish a separate institute named as 'Indian Institute of Membrane Science and Technology' during each of his several visits to this country. The conference, therefore, strongly recommends to the Government of India and CSIR to consider the establishment of such an institution.

4. Work of excellence can be stimulated under an environment of encouragement and competitive spirit. In order that membrane research may take a firm root and blossom into activities of relevance to Indian industries, it is suggested that an award (once in three years) for a total indigenous membrane technology may be instituted by the industries and membrane societies.

5. The conference has brought out the fact that membranes have innumerable applications. It is necessary to identify and formulate industrially important areas with short-term and long-term benefits. To accomplish this, it is necessary that a task force be set up to examine the interest of industries, the existing capabilities of carrying out research in these areas as well as steps to be taken up to create the necessary infrastructure and develop suitable expertise within the country.



Dr S.K. Joshi delivering the presidential address at the National Conference on Synthetic Membranes and Their Applications. Seated on the dais (from right) are : Shri K.D. Padia, Dr A.V. Rao, Prof. M.M. Sharma, Prof. M.M. Taqui Khan and Dr V.K. Indusekhar

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## Workshop on CSIR Inputs for Entrepreneurship Development Programmes

At a suggestion of the Directorate of Industries, Uttar Pradesh, and with the aim to create awareness about CSIR technologies and the role of CSIR in entrepreneurship development programmes and creation of job opportunities, the CSIR Polytechnology Transfer Centre (PTC), Lucknow, organized a one-day workshop on 'CSIR Inputs for Entrepreneurship Development Programmes'. Held at the Regional Science Centre, Lucknow, on 11 October 1991, the workshop was attended by representatives of voluntary organizations, industry departments and scientists and experts from the Central Drug Research Institute, National Botanical Research Institute, Central Institute of Medicinal and Aromatic Plants, PTC, Rural Housing Board and the Central Food Technological Research Institute's Regional Centre at Lucknow.

Dr M.C. Upreti, Scientist-in-charge, PTC-Lucknow, apprised the audience about the objectives of the workshop. He also gave general information about the CSIR network, achievements, technologies and facilities provided by CSIR laboratories, and the objectives and services of PTC - Lucknow. Shri A.N.Dey, Project Coordinator, Regional Science Centre, spoke on the importance of EDPs in solving unemployment problems.

The main session of invited lectures was started by Dr Roma Mitra, Scientist, NBRI, who explained about dehydration of flowers, modernization of betel farming, wasteland utilization and floriculture. Samples of greeting cards, wall hangings, etc. made

with dehydrated flowers were also shown by Dr Mitra. Relevant literature in Hindi was also distributed.

Dr A.K. Singh, Scientist, CIMAP, gave an account of the R&D activities of his institute and agrotechnologies available for the cultivation and processing of medicinal and aromatic plants.

Shri Durgesh Pant, Supdt. Engineer, Rural Housing Board, stressed upon the use of simple techniques for saving materials like brick and cement during construction, and the use of low - cost durable technologies developed by CBRI, Roorkee, viz. fire proof thatched roof, non-erodable mud plaster, wastewater disposal system and solar timber seasoning kiln, etc.

Shri Kishori Lal and Shri Satpute, Scientists, CFTRI Regional Centre, Lucknow, apprised the participants about the different technologies developed by CFTRI for food processing, potato products, tomato products, dehydration of vegetables, mini pulse and flour mill, etc. These scientists also informed about the services and facilities offered by CFTRI.

During question-answer session, the general queries were answered by Dr Upreti and technical questions were answered by the experts. The house suggested that PTC-Lucknow should organize more of such programmes in future. The workshop was concluded with the vote of thanks by Dr R.K. Srivastava, Scientist, PTC-Lucknow.

The following CSIR publications and leaflets prepared by PTC were distributed to the participants: R&D capabilities of CSIR; Scientific and technological capabilities - CSIR; PTC pamphlet describing major contribution of CSIR to (a) Society (b) Industries and (c) Basic Research; Polytech-

nology Transfer Centre - Service rendered during a decade (Hindi); and Technologies of CSIR, Primary lesson (in Hindi). □

## Synthesis and biological activity of N-substituted acetoacetamide derivatives and related compounds

As a part of the continuing programme at the Indian Institute of Chemical Technology (IICT), Hyderabad, on the synthesis of compounds acting on the central nervous system, Shri K. Ram Mohan Reddy synthesized a series of N-dialkylacetoacetamide derivatives and related compounds and tested their biological activity.

His Ph.D. thesis describes the synthesis of representative series of secondary/ aralkylamino salts of N-diethyl acetoacetamide, their corresponding enamines of N-diethyl acetoacetamide and N-diethyl-2-chloro acetoacetamide belonging to a hitherto not well explored class of enamines. Substituted amino-N-diethylcrotonamides have been used for a relatively facile synthesis of 1,4-dihydropyridine derivatives and newer derivatives of N-diethyl-2 (aralkylamino/heterocyclic amino)- acetoacetamide have been highlighted.

Synthesis of the following three series of compounds has been described : (i) substituted phenylhydrazono-N- diethylacetoacetamides and (ii) their corresponding 1-quinolino- 3-methyl-4(substituted phenylhydrazono)-5-pyrazolone derivatives, and (iii)  $\alpha$ -acetyl- $\beta$ - (substituted anilino)-N-substituted phenyl-acrylamides. The phenyl hydrazono-N-diethylacetoacetamide aroused interest owing to their rearrangement of phenylazo-N-diethyl acetoacetamide to the most stable phenylhydrazono-N-diethyl acetoacetamide. The structural features

posed by these compounds are brought out by a comparison of their IR, NMR, and X-ray studies.

The synthesis of new 4-aryl-1, 4-dihydropyridines as possible cardiovascular drugs and a brief account of the important cardiovascular drugs currently in use and their mode of action have been presented. A series of 3,4-dihydro-6-methyl-5-N-diethylcarbamoyl-4-(substituted phenyl)-2(1H)-pyrimidone and pyrimidone thiones have also been described as possible CNS depressants.

The pharmacological evaluation shows that many of these compounds possess important pharmacological activities, e.g. 4-aryldihydropyridine derivatives exhibit marked blood pressure reducing activity comparable to that of the standard drug Nifedipine.

Substituted phenylhydrazono-N-diethyl-acetoacetamides and corresponding 1-quinolino-3-methyl-4(substituted) phenylhydrazono)-5-pyrazolones display an interesting profile of insecticidal activity against *Strophilus oryzae*.

The results of pharmacological evaluation clearly indicate that the series of compounds studied are effective medicinal agents, possessing marked blood pressure reducing activity and antimicrobial activity.

Shri Reddy worked under the guidance of Dr Y.S. Sadanandam, Scientist EII, IICT, and was awarded Ph.D. degree by the Osmania University, Hyderabad, for his thesis. □

### Phase equilibria and activity coefficients

The limiting activity coefficients of compounds in liquid mixtures characterize the behaviour of single solute molecule completely surrounded by solvent molecules and thus offer incisive information

to the theorist. These limiting activity coefficients are also useful for predicting phase equilibrium behaviour over the entire composition range through appropriate solution models. Thus the measurement of limiting activity coefficients offers a great incentive both to theorist and design engineer. Gas chromatography (GC) is an excellent technique for evaluating equilibrium data at infinite dilution with high accuracy. This method is being widely used for measuring various thermodynamic and transport properties since the last two decades.

Using GC, Shri S.M. Ashraf studied at the Indian Institute of Chemical Technology (IICT), Hyderabad, two types of solute-solvent interactions: in the first type, a volatile solute was made to interact with nonvolatile solvent molecules, whereas in the other, both the solute as well as solvent were volatile. The data obtained were used for the estimation of UNIFAC group interaction parameters. The UNIFAC group interaction parameters were estimated by minimization of an objective function using Nelder and Mead technique.

A variety of nonvolatile solvents consisting of phthalate group, phosphate group and amine group were selected for these studies. The limiting activity coefficients for aliphatic alcohols (C<sub>1</sub>-C<sub>5</sub>), a series

of aromatic hydrocarbons, aliphatic ketones and esters were measured. This work yielded 63 new UNIFAC interaction parameters which are not available in literature.

The second phase of work, where both the components of the system were volatile, consisted of polar-polar interactions like alcohol-ketone, polar-nonpolar interactions like alcohol-hydrocarbon and nonpolar-nonpolar interactions like hydrocarbon-hydrocarbon. A few of the data, which are available in literature in the form of conventional vapour liquid equilibrium data, showed excellent agreement with the experimental data. In all, 50 such systems were studied and Wilson parameters were evaluated from these studies.

The phase equilibrium data of industrially important systems described by Shri Ashraf are of great significance as they are useful for screening the solvents in the separation processes, such as extractive distillation and liquid extraction.

The above work by Shri Ashraf was carried out under the supervision of Dr M. Ramakrishna, Scientist, IICT and Prof. M. Bhagwanth Rao, Principal, College of Technology, Osmania University, and the thesis based on the work qualified him for the award of Ph.D. degree by the Osmania University.

## Human Developmental Neurobiology

### Dr Shashi Wadhwa's Bhatnagar Prize-winning Work\*

Dr Shashi Wadhwa's significant contribution has been in the area of human developmental neurobiology. Her work outlines the time periods during which developmental events of cell

proliferation, migration, excessive production of optic axons and their elimination, synaptogenesis and dendritic proliferation occur in the human lateral geniculate nucleus (LGN) which is an important relay

\*Dr Shashi Wadhwa, Department of Anatomy, All India Institute of Medical Sciences, New Delhi, has been awarded the Shanti Swarup Bhatnagar Prize in Medical Sciences for the year 1991 [CSIR News, 41(1991), 232].

ation in the visual pathway.

Since the introduction of monocular deprivation paradigm by Wiesel and Hubel, extensive work has been carried out on ex-



perimental animals to study the effect of sensory deprivation by monocular enucleation on early postnatal visual development with a view to understanding the visual loss in human amblyopias. Studies on the removal of one eye before birth have also demonstrated permanent changes in cellular organization and synaptic connectivity in the visual centres of animals. These studies provided evidence that the process of normal development can be disrupted both during prenatal and postnatal life besides serving as models to understand the mechanisms of normal development.

Prenatal development of the visual pathways in humans has received very little attention. From the studies on the normal development of lateral geniculate nucleus in different mammals it was evident that there is a striking variation in the time of neurogenesis and maturation of the neurons. As it was important to analyze prenatal morphological development of human LGN to make comparison with and explanation from animal experi-

Availability of human fetal cadavers due to the legalization of abortion made it possible to undertake the study to analyze the extent to which neurons differentiate and determine how far the neuronal circuitry is formed prenatally in the human LGN with the help of modern techniques of electron-microscopy and immunocytochemistry. Dr Wadhwa has also demonstrated the chronology of development of the neurotransmitter profile of gamma aminobutyric acid (GABA), Substance P, serotonin acetylcholine and noradrenaline in the human LGN.

A linear growth in volume of LGN has been observed which is not uniform but is associated with a major significant expansion in volume between 15 and 20 weeks of gestation as evidenced by the lack of migrating cells at this age and peak numerical cell density at the gestational age of 12 weeks. Subsequent to this there is a fall in numerical cell density. The fall in density is rapid during 16-18 weeks of gestation. During this phase, other correlative events which occur include the peak in formation of optic nerve fibres which project to the LGN and a significant increase in synapse formation. Two other relevant observations made during this period are: a large number of substance P positive afferents and the presence of 16% of GABA immunopositive neurons which represent the peak numerical densities. Subsequent growth in volume and increase in neuropil occur at a somewhat slower pace. During this later period of gestation, dendritic proliferation along with further addition of synaptic profiles has been observed.

Dr Wadhwa's study has highlighted multiple overlapping sensitive and critical periods in the development of human LGN during

which various vital growth processes occur and could render this nucleus susceptible to microenvironmental influences. Her study has provided a morphological basis for neuropathological investigations in various developmental disorders of this human visual nucleus and paved way for more direct comparisons with the experimental findings obtained from studies on subhuman mammals.

Dr Wadhwa graduated in medicine from Jabalpur University (1970) with distinction in Anatomy and took her Master's (1974) and Ph.D. (1987) degrees in Anatomy from the All India Institute of Medical Sciences, New Delhi. She is recipient of the H.K. Chatterjee Gold Medal (1983) of ASI and the Shakuntala Amir Chand Prize of ICMR (1988). She is currently an Additional Professor at the AIIMS. She has around 90 publications in journals and books and has co-edited four books on Neurobiology.

## TRAINING COURSES

### Training Programme on Lead Acid Battery

The Central Electrochemical Research Institute (CECRI), Karaikudi, jointly with CSIR Polytechnology Transfer Centre, Bhopal, organized a training programme on lead acid battery, for technicians engaged in the trade, during 20 - 21 September 1991. Twenty-two participants from various battery manufacturing units participated in this programme. Dr P.G. Balakrishnan and Shri N. Mani, scientists from CECRI, delivered lectures in Hindi and also demonstrated the various operations involved in the fabrication of batteries. The programme was held to help bring about improvement in the quality of batteries manufactured by various units in small scale sector. □

## Dr P. Nataraja appointed Director of CSMCRI

Dr P. Natarajan, Professor and Head, Department of Inorganic Chemistry, University of Madras, has taken over as Director, Central Salt & Marine Chemicals Research Institute (CSMCRI), Bhavnagar, following Prof. M.M. Taqui Khan's retirement on attaining superannuation on 30 November 1991.

Dr Natarajan (born 17 Sep. 1940) did his B.Sc. from the



University of Madras in 1959 and M.Sc. from the Banaras Hindu University in 1963. In 1966, he went to USA to work for his Ph.D. degree under the guidance of A.W. Adamson at the University of Southern California, USA. He obtained his Ph.D. degree in 1971. During 1971-72, he worked as a Post-doctoral Research Associate with J.F. Endicott at the Wayne State University, USA. He served as Reader, Department of Physical Chemistry, University of Madras, during 1974-77 and was Professor and Head, Department of Chemistry, University of Madras Post-graduate Centre, during 1977-82. He joined the Department of Inorganic Chemistry, University of Madras, as Professor and Head, in 1982.

Dr Natarajan's areas of specialization relate to: Inorganic photochemistry, photophysics of coordination compounds, flash photolysis studies of organic and

inorganic systems using lasers, fast reaction kinetics, photochemistry of macromolecules, solar energy conversion by chemical methods, photoelectrochemistry, radiation chemistry and pulse radiolysis. He has completed several research projects sponsored by DST, UGC and CSIR, in the areas of coordination compounds, photogalvanic potentials and photodegradation of monomeric and polymeric systems. Sixteen students have obtained their Ph.D. degrees under his guidance.

Dr Natarajan has visited USA, UK, Japan, France and Switzerland on a number of scientific assignments. He received 'Best Teacher Award' in 1984 from the Government of Tamil Nadu, and the Shanti Swarup Bhatnagar Prize in Chemical Sciences, in 1984, from CSIR. He is a Fellow of the Indian Academy of Sciences, and Indian National Science Academy. He is a member of the American Chemical Society, New York Academy of Sciences and Sigma Xi-Scientific Research Society, and was member of editorial boards of *Indian Journal of Chemistry* during 1986-91 and *Proceedings of Indian Academy of Sciences* during 1986-89. He is serving on various Advisory Committees of DST, CSIR and UGC at present.

## Honours & Awards

### CEERI Scientists get K.S. Krishnan Memorial Award

The paper entitled 'Microprocessor-based Control Strategies and Role of ASICs in Sugar Crystallisation Process' by Pawan Kapur, V.L. Patil, G.K. Gautam, T.R. Vasudeva and G.N. Acharya of the Central Electronics Engineering Research Institute (CEERI), Pilani,

published in *IETE Technical Review* (May-June 89) has been conferred the K.S. Krishnan Memorial Award by the Council of the Institution of Electronics and Telecommunication Engineers. It is the best system-oriented paper published in the journal.

### Shri U.M. Rao gets Bimal Bose Award

The Seventh Bimal Bose Award has been conferred by the Institution of Electronics and Telecommunication Engineers to Shri U.M. Rao, Scientist, Central Electronics Engineering Research Institute (CEERI), Pilani, for his outstanding contribution to the field of Power Electronics.

## PATENTS FILED

526/DEL/91: An improved method for the removal of stain from coriander, P.P. Thomas, Gopalakrishnan, N. Sudhila, P. Poulouse and E. Varghese—Regional Research Laboratory, Trivandrum.

527/DEL/91: Improvements relating to spinel type anode electrowinning of metals in aqueous electrolytes, S. K. Kandasamy, J.P. Rethinaraj, S. Chockalingam and S.I. V. vanathan—Central Electrochemical Research Institute, Karaikudi.

528/DEL/91: A process for making water soluble deflocculant and emulsion from coal tar pitch, B. Mazumder, M.M. Bora and B. Chaliha—Regional Research Laboratory, Jorhat.

537/DEL/91: A process for preparation of novel alkyl fumarate alkyl acrylate vinyl ester polymer useful as pour point depressant and fluidity improver for waxy crude oils, A. Borah, N.C. Laskar, R.K. Majumder, Rao and B. Subrahmanyam—Regional Research Laboratory, Jorhat.















